DOCUMENT RESUME

ED 217 248 CE 032 884

TITLE Plumbing. Pre-Apprenticeship Phase 1 Training. Instructor's Guide.
INSTITUTION Lane Community Coll., Eugene, Oreg.
SPONS AGENCY Employment and Training Administration (DOL), Washington, D.C.; Oregon State Dept. of Education, Salem.
PUB DATE [79]
NOTE 117p.; For related documents see CE 032 866-930 and ED 213 887-905.

EDRS PRICE MF01/PC05 Plus Postage.
DESCRIPTORS Behavioral Objectives; *Building Trades; Construction (Process); Construction Materials; Equipment; Hand Tools; Learning Activities; Lesson Plans; Mathematics; Occupational Information; *Plumbing; Postsecondary Education; Safety; Teaching Guides; Teaching Methods; Tests; *Trade and Industrial Education; Two Year Colleges; Units of Study
IDENTIFIERS *Preapprenticeship Programs

ABSTRACT

This instructor's guide accompanies the self-paced student training modules on plumbing, one of which is available separately as CE 032 885. Introductory materials include a description of the components of the pre-apprenticeship project, a discussion of the teacher's role in conducting the course, and scope and content of the four phases of training. The guide contains 11 units organized according to this format: title; instructional outcomes; introduction; and presentation, including a teaching outline of the unit and teaching methods and aids referenced to student modules. Job sheets and drawings are provided as needed. Topics covered in the units include the following: introduction to the plumbing trade, diagnostic testing, survival skills, trade mathematics, physical requirements, safety, first aid, trade tools, materials, processes, and a plumbing project. An appendix contains an occupational analysis (task inventory) of the plumbing trade. (KC)

****
* Reproductions supplied by EDRS are the best that can be made *
* from the original document. *
****

ED217248

INDIVIDUALIZED LEARNING SYSTEMS

PRE-APPRENTICESHIP

PHASE 1 TRAINING
Instructor's Guide

Plumbing

Diagnostic Tests
Survival Skills
Math
Tools
Materials
Project

000183

CE 032 884

U.S. DEPARTMENT OF EDUCATION
NATIONAL INSTITUTE OF EDUCATION
EDUCATIONAL RESOURCES INFORMATION CENTER (ERIC)

✓ This document has been reproduced as received from the person or organization originating it.
Minor changes have been made to improve reproduction quality.

• Points of view or opinions stated in this document do not necessarily represent official NIE position or policy.

"PERMISSION TO REPRODUCE THIS MATERIAL HAS BEEN GRANTED BY

C. Horstrup

TO THE EDUCATIONAL RESOURCES INFORMATION CENTER (ERIC)."

This project was developed under a subcontract for the Oregon Department of Education by Lane Community College, Community Education Division, Eugene, Oregon. Funds were provided by the Governor of Oregon from the Educational Linkages Component of the CETA Governor's Grant.

STATEMENT OF ASSURANCE

It is the policy of the Oregon Department of Education that no person be subjected to discrimination on the basis of race, national origin, religion, sex, age, handicap or marital status in any program, service or activity for which the Oregon Department of Education is responsible. The Department will comply with the requirements of state and federal law concerning nondiscrimination and will strive by its actions to enhance the dignity and worth of all persons.

INTRODUCTION TO PRE-APPRENTICESHIP

DESCRIPTION OF APPRENTICESHIP

The Federal Bureau of Apprenticeship identifies an apprenticeable occupation as a skilled occupation that requires a minimum of one year of 2000 hours on-the-job training. This on-the-job training and related educational training is the apprenticeable period.

VIEWPOINTS ABOUT PRE-APPRENTICESHIP

Pre-apprenticeship is viewed in many different ways by craftpersons, apprenticeship committees, educators and the general public.

Concerns about pre-apprenticeship include the belief that the pre-apprenticeship training will flood the market with applicants for apprenticeship or that these trainees will go to work in the occupation as partly trained workers or that pre-apprenticeship would be considered a guarantee of entry into apprenticeship. These conflicting viewpoints create problems for persons interested in apprenticeship training and make it difficult to operate pre-apprenticeship training programs.

NEED FOR PRE-APPRENTICESHIP

Pre-apprenticeship provides three benefits:

1. Provides a screening device to determine motivation, interest, manipulative aptitude and ability of persons to learn the skills of the occupation.
2. Provides the individual with survival skills for handling personal problems and interpersonal relations on the job that may include abuse and sexual harrassment.
3. Provides entry level skills to help make the apprentice productive from the first day on the job. The higher entry level skills of the apprentice provides an incentive for the employer to hire apprentices.

PRE-APPRENTICESHIP HELPS PEOPLE

To select a skilled occupation.
To identify the educational requirements of an occupation.
To experience the hands-on skills of an occupation.
To develop good work habits.

* Good job attendance
* Punctuality
* Dependability
* Time management

To develop good attitudes.

* Concern for the job
* Initiative
* Interest
* Healthy, cooperative working relations with fellow employees.

TRAINING LEVELS FOR PRE-APPRENTICESHIP

Pre-apprenticeship training can be separated into three phases or stages of training. These are:

PHASE 1

Provides the trainee with an opportunity to explore several occupations. This orientation to the trowel trades includes training in trade terminology, blueprint reading, tool usage, first aid and safety practices. This familiarization training includes hands-on experience in some of the basic skill areas together with information about the advantages and requirements of trowel trade work. The choice of an occupation to train for in Phase 2 of pre-apprenticeship will be based on these experiences. If the trainee decides not to pursue this occupation any further, the training received to this point will be useful in every day life.

Phase 1 includes diagnostic tests to determine if reading or mathematical deficiencies exist that would handicap a person in the trowel trades. Remedial work will be provided to correct these deficiencies.

Success on the job is directly related to job attitudes, work habits, and the individual survival and coping skills. Training will begin on helping each individual attain full potential in these personal skills.

Interpersonal skills will be developed which include:

* Communication skills
  - paraphrasing, perception checks, non-verbal communication
  - communicating with superiors
* Personal effectiveness
  - problem solving, family relationships, sexual harrassment and pestering on the job.
* Interview techniques
  - apprenticeship committee interview procedure

PHASE 2

This training begins the serious preparation for an occupation. The training related to job attitudes, work habits and individual survival and coping skills will be continued from Phase 1 with more emphasis on the relationship to the job.

Manipulative skills will be developed by the completion of a series of projects involving basic trade skills which have a carryover benefit to persons outside of the occupation. At least 3/4 of the training will consist of hands-on experiences. This instruction should be conducted by a skilled craftsperson from the trade or occupation who has the necessary teaching skills.

The joint apprenticeship committee for the occupation will be invited to observe the progress of trainees during Phase 2 and to evaluate the potential for trainees for entry into apprenticeship. The participation of the appropriate joint apprenticeship committee is essential to the success of a pre-apprenticeship program. This community involvement insures that the training is relevant to the occupation and meets industry training standards.

At the completion of Phase 2 the trainee will have enough experience with the occupation to decide whether to continue with the training into Phase 3. The joint apprenticeship committee will have knowledge of the quality of the training program and will be in a position to judge the qualifications of the students for entry into the apprenticeship training program.

PHASE 3

Training is concentrated on improvement of manipulative skills so that the trainee will be a productive employee the first day on the job. This training can be either industry conducted specialized training, secondary school vocational programs or community college preparatory courses specifically related to the occupation. Trainees can also participate in co-op work experience involving hands-on training at the secondary or community college level. Hands-on training is considered essential for an effective pretraining program.

The Phase 3 training period provides the trainee with an opportunity to search for an employer willing to take an apprentice. Frequently the employer providing co-op work experience training will hire the trainee as a regular employee.

It is possible that some employers will hire the trainee without further training. Some of these employers train specifically for their own needs. In the process, job descriptions have become highly diluted. Instead of producing journeymen possessing a wide range of skills, companies have settled for specialists trained to perform the specific tasks needed in certain narrow operations. While this may be adequate to meet the special needs of an industry, it certainly will not meet the training and manpower needs of the nation in the future.

Apprenticeship provides a broad base of training by giving the apprentice a wide range of skills which insures continuous employment. Workers least vulnerable to unemployment are those with the highest and broadest skills and best training. The trainee should make every effort to enter an apprenticeship training program designed to provide training in all skills required

in the trade or go to work for an employer who will provide broad based training.

Each trainee will choose a joint apprenticeship committee meeting to attend during Phase 3 training. This will provide an opportunity for the trainee to become acquainted with members of the joint apprenticeship committee and to see how the committee functions.

PHASE 4 EMPLOYMENT AS AN APPRENTICE

Trainee enters apprenticeship training on a direct referral basis under agreement with the appropriate joint apprentice committee which permits persons trained in programs financed with federal funds to enter apprenticeship on direct referral. Direct referral eliminates several of the procedures in the selection process and makes entry into apprenticeship less cumbersome.

Not all joint apprenticeship committees use the direct referral system. This is the reason why sponsors of pre-apprenticeship training should directly involve joint apprenticeship committees in the operation of their programs. This provides committees with an opportunity to evaluate the effectiveness of pre-apprenticeship.

The federal Job Corps Programs enjoy direct referral placement in apprenticeship for their graduates. The Job Corps operates an ideal pre-apprenticeship program. Proposed sponsors of pre-apprenticeship training are advised to visit the nearest Job Corps Center to see how the programs operate.

The Job Corps Centers in Oregon are located at:

Angel Job Corps
Star Route North
Yachats, OR 97498
547-3137

Timber Lake Job Corps
Star Route Box 109
Estacada, OR 97023
834-2291

Wolf Creek Conservation Center
Little River Route
Glide, OR 97443
496-3507

Tongue Point Job Corps
Astoria, OR 97103
325-2131

Job Corps Centers in Oregon Offer Training in these apprenticeable occupations:

Carpentry	Plastering	Automotive
Cement Mason		Painting
Brick Laying	Tile Setting	

RECOMMENDED PROCEDURE FOR CONDUCTING PRE-APPRENTICESHIP TRAINING

ADMINISTRATION

Pre-apprenticeship training can be conducted by various sponsors. These include: secondary schools, community colleges, unions, employer associations, labor/management training trusts and private groups such as O.I.Cs.

ADVISORY COMMITTEES

Use of broad-based community advisory committees is mandatory for pre-apprenticeship programs conducted by secondary schools and community colleges. Pre-apprenticeship needs the support and recognition of the community in order to be successful.

The advisory committee should have representatives from these groups:

School administration
- -high school principal
- -board members
- -vocational director
- -co-op work experience
- -T & I instructors

Community
- -school graduate in trade
- -member of joint apprenticeship committee
- -employer member of trade
- -employee member of trade
- -union business agent
- -industry training coordinator
- -representative of financial community
- -representative of press

Government personnel
- -ESD regional vocational coordinator
- -Oregon Division of Apprenticeship field representative
- -Federal Bureau of Apprenticeship representative
- -State Dept. of Education specialist

FINANCING

Vocational training programs generally cost more than academic programs because the student/teacher ratio is smaller, consumable supplies are required, and expensive equipment is needed. Resources to finance pre-apprenticeship training are available from a number of sources. These include:

Vocational rehabilitation	-tuition fees
Federal funds for immigrants	-Asian -Cuban -Spanish American
Special grants	-U.S. Dept. of Labor U.S. Dept. of Education CETA Industry State Dept. of Education Economic Development Administration
Secondary school funding	-basic school grant from federal funds
Community college funding	-basic state funding

INSTRUCTIONAL DELIVERY SYSTEMS

The type of sponsor for pre-apprenticeship training will determine the time-block used for the program. If training is started at the 9th grade level, a two-hour training period will generally be used. A half-day training period should be used for an accelerated program at the secondary level covering two years. Community college programs can be either half-day or full-day programs. Private sponsors generally will operate on a full-day basis.

Instructors for the trade specific training should be qualified craft workers. These may be employed on a part-time basis, or full-time, serving several programs. The necessity for skilled workers to teach the trade specific items of the program

cannot be over-emphasized. The work experience of skilled craft workers gives them the insight into the occupation needed for effective teaching.

MANIPULATIVE SKILL TRAINING

The manipulative skills or hands-on experiences provide the basis for a sound and effective pre-apprenticeship training program. Unless this training is available the program will not succeed.

Important considerations involve the following items:

Basic tools	-tools required for each participant
General or shop tools	-power tools (purchased or rented)
Materials	-purchased by training agency -purchased by others (training project sponsor) -donations by industry (defective goods)
Training facilities	-school based -community based
Training projects	-school maintenance work -simulated projects -community projects -private projects (non-profit organizations-low income persons)

COORDINATION WITH EXISTING PROGRAMS

Pre-apprenticeship should be coordinated with related programs in secondary schools and community colleges.

Welding	Electronics
Blueprint reading/drafting	Industrial mechanics cluster
Surveying	Construction cluster
Automotive	Electricity/electronics cluster

MISCELLANEOUS CONSIDERATIONS

Legislation, community support and political considerations will all have an effect on pre-apprenticeship training. Activities related to these concerns include:

Workshops and technical assistance	-State Dept. of Education
Publicity notices	-public service -newspaper -radio -translation to Asian/Spanish American
Civil rights	-effect of civil rights compliance
Transfer of learning	-benefits of vocational training to other occupational endeavors

COURSE OUTLINE

1.0 Introduction to the Plumbing Trade

- 1.1 History
- 1.2 Trends
- 1.3 Working Conditions
- 1.4 Places of Employment
- 1.5 Hiring Practices
- 1.6 Wages
- 1.7 Common Worker Benefits
- 1.8 Trade Terminology

2.0 Diagnostic Testing

- 2.1 SATB

3.0 Survival Skills

- 3.1 Expectations
- 3.2 Communication Skills
- 3.3 Giving and Receiving Feedback
- 3.4 Dealing with Interpersonal Conflict
- 3.5 Group Problem Solving, Goal Setting and Decision Making
- 3.6 Wider Influences and Responsibilities
- 3.7 Identifying and Developing Individual Strengths
- 3.8 Worksite Visits
- 3.9 Resumes
- 3.10 Interviews
- 3.11 Appropriate Work Habits and Attitudes

4.0 Trade Math

- 4.1 Math Diagnosis
- 4.2 Math Remedial

5.0 Physical Requirements

- 5.1 Physical Requirements
- 5.2 Developmental Processes

6.0 Safety

- 6.1 General Safety
- 6.2 Personal Safety
- 6.3 Fire Types and Prevention
- 6.4 Hygiene Safety
- 6.5 Hand Tool Safety
- 6.6 Power Tools

7.0 First Aid

7.1 First Aid

8.0 Trade Tools

8.1 General Tools

9.0 Materials

9.1 Galvanized Steel
9.2 Copper
9.3 ABS
9.4 PVC
9.5 Cast Iron

10.0 Processes

10.1 Basic Processes

11.0 Project

II. WORD TO THE INSTRUCTOR

This course was designed to be a trade-related, self-screening, job exploration package, providing the student with basic trade theory, basic trade manipulative practice, projects and on-job-site visitations.

Further, it is to be implemented by instructors who are skilled in each of the general topics described in the course outline and expanded on in the instructor's guide.

The curriculum is comprised of two parts: 1) the instructor's guide, and 2) supporting modules and references which are specified in the instructor's guide. The instructor should seek other supporting resources where available or necessary.

The instructor should bear in mind that there are two broad objectives written into the design of this course: 1) that the student will receive instruction in the preapprenticeship mode of the trade (which is designed to enable him or her to gain enough exposure to the trade to (a) aid in making a career decision, and (b) facilitate entry into the trade), and 2) that the student will retain some carryover skills which he or she can use in life, even should the student decide not to enter the trade.

Essentially, this guide is patterned after a program begun in Oregon in 1979-80. The participants in the program are wholly CETA-sponsored, many with motivational or physical impairments. The program concentrates on providing motivational support and/or physical therapy. A typical program, broken down into its major components, would be:

- 40% hands-on, manipulative work
- 30% motivational support work
- 10% job visitation
- 5% physical development or therapy
- 15% class lecture, discussion, etc.

Not all institutions will have the resources, nor will all programs' students have the need, for such a breakdown. The instructor should identify the needs of the students and utilize the guide in the manner best suited to meet them.

III. RECOMMENDATIONS

Hands-on work is probably the best learning experience for students in trade work. It is essential if the two broad objectives listed above are to be met. Therefore, implied in the topics covering tools, materials and tasks or work processes is the notion (emphasized in the Instructional Outcome for these topics) that the student will practice using the tools and materials described therein.

In lieu of describing in the Teaching Methods and Aids section of the guide those tasks which will be performed with the described tools and materials, the writers leave it to the imagination and material resources of the instructor. Practice is the method by which skill is developed.

Not all institutions will have the resources, nor will all programs' students have the need, for such a breakdown. The instructor should identify the needs of the students and utilize the guide in the manner best suited to meet them.

III. RECOMMENDATIONS

Hands-on work is probably the best learning experience for students in trade work. It is essential if the two broad objectives listed above are to be met. Therefore, implied in the topics covering tools, materials and tasks or work processes is the notion (emphasized in the Instructional Outcome for these topics) that the student will practice using the tools and materials described therein.

In lieu of describing in the Teaching Methods and Aids section of the guide those tasks which will be performed with the described tools and materials, the writers leave it to the imagination and material resources of the instructor. Practice is the method by which skill is developed.

1.0 Introduction to the Plumbing Trade

INSTRUCTIONAL OUTCOMES: The student will be able to identify and briefly explain the history, trends, working conditions, places of employment, hiring practices and wage scale, as well as working people's benefits and trade terminology.

INTRODUCTION: In order to become an effective worker or make an effective realistic career decision, an individual must be exposed to various aspects of the trade.

PRESENTATION

TEACHING OUTLINE	TEACHING METHODS AND AIDS
1.1 History A. Developing adequate water and sewage systems has always been a problem of civilizations. 1. Evidence of plumbing systems has been found to date back to 4500 B.C. B. The Romans built aquaducts to carry water to their cities. 1. Excavations show knowledge of masonry and hydraulics. a. discovered were municipal sewers, cesspools for private homes, public restrooms and a thousand public baths.	Explain and Discuss ILS Introduction to the Plumbing Trade

C. Improvements of plumbing facilities did not occur until 19th century.

D. Primitive sanitation during the Industrial Revolution led to outbreaks.

E. Epidemics were controlled with the development of separate underground water and sewage systems.

F. Plumbing fixtures (sinks, bathtubs, toilets) were invented to bring potable water into buildings and carry wastes out.

G. During the 20th century, numerous plumbing improvements have contributed to the health of households.

1.2 Trends

A. Employment opportunities for plumbers and pipefitters will grow through the 1980s.

B. Plumbing growth relies on construction activity.

C. Air conditioning, solar heating and new kitchen appliances will create new plumbing challenges.

D. Fuel and power-plants will expand and create plumbing and pipefitting jobs.

1.3 Working Conditions A. Pipefitters' and plumbers' work is strenuous. 1. Working in awkward positions or standing for long periods. B. Injury rate for contracted employees is higher than for manufacturing firms. 1.4 Places of Employment A. Plumbers or pipefitters work for contractors or are self-employed. 1. There were 428,000 workers in 1978. 1.5 Hiring Practices A. Plumbers and pipefitters learn their trade in two ways. 1. Helpers to journeymen for several years. 2. Enter an apprenticeship program (sponsored through union-management agreements). B. Apprentice helpers spend four years in on-the-job training. C. Classroom training is for 216 hours a year. D. Applicants must be eighteen years old. 1. A high school diploma is desirable with chemistry, math, mechanical drawing, physics and shop courses.	Jobsite Visitation Invite Job Specialist

2. Some communities require a trade license.
   a. trade license determines knowledge of trade and local plumbing codes.

1.6 Wage Scale

A. In 1978 plumbers averaged over $10 per hour.

B. Apprentices receive 40% to 50% of rate paid journeyman workers.
   1. Increases are paid every six months.

1.7 Common Worker Benefits

A. Unemployment Insurance
   1. Purpose.
      a. transition from job to job.
      b. ease strain of layoffs.
   2. Source of benefits.
      a. payroll tax on wages.
   3. Eligibility.
      a. depends on base year earnings.
      b. depends on reasons for leaving work.
   4. Level of benefits.
      a. level of base year earnings.
   5. Claims process.
      a. report to Employment Division office.
      b. provide required information.
         (1) employer's name and address.
         (2) your social security number.

ILS Common Worker Benefits
Invite Field Rep
Workmen's Compensation Board
BOL Wage and Hour
Employment Division

(3) wage earning records.
(4) current address.

6. Appeals/hearing process.
   a. initiated by worker.
   b. in writing.
   c. within time limits.

B. Wage and Hour Commission
   1. Purpose.
      a. to investigate and attempt equitable settlement of wage claims.
   2. Areas of claim review.
      a. pay periods.
      b. pay days.
      c. final pay days.
      d. wage payments in cases of dispute.
      e. methods of compensation and overtime.
      f. minimum wage laws.
      g. limitation of hours in certain industries.
      h. restrictions on employment of minors.
   3. Jurisdiction.
      a. Federal vs. State.
   4. Claim Process.
      a. contact wage and hour commission.
      b. provide required information on appropriate form.
         (1) dates of employment.
         (2) rate of pay.
         (3) reason for non-payment.
         (4) estimate of disputed amount.
      c. wage claim conference.
      d. collection process.

e. protection against retaliation for filing a claim.

5. Time limits for filing.

a. regular pay.

b. overtime pay.

C. Workers Compensation

1. Purpose

a. provide medical care payment for on-the-job accidents.

b. provide time loss payments.

c. provide payments for permanent disability.

d. provide death benefits.

2. Source of benefits.

a. employer premiums for insurance.

b. employee contributions.

3. Level of benefits.

a. complete for medical costs.

b. varies according to level of final disability.

4. Eligibility.

a. any job-related accident or condition causing the worker to leave work and seek medical treatment.

5. Claim process.

a. report accident to employer.

b. fill out claim form.

(1) know your employer's legal name.

(2) know your employer's insurance carrier.

c. see your doctor for treatment.

6. Final determination.
   a. doctor's statement of stabilized condition.
   b. board's findings of disability and payment.
7. Reopening claim for aggravation of injury without a new injury.
   a. contact employer's insurance company if occurs within the first five years.
   b. contact worker's compensation board after five years.

1.8 Trade Terminology

A. Common Trade Terms

1. Burr--rough edge on metal left by cutting tool.
2. Die--tool used in cutting threads on pipe.
3. Pipe cutter--tool used to cut pipe to length.
4. Cutting--sectioning material into predetermined lengths.
5. Reaming--process of cleaning inside lip of pipe after cutting.
6. Threading--process of cutting thread on pipe end with die and ratchet.
7. Union--coupling joint used in repairs to provide intermediate access to line without complete disassembly from beginning of line.
8. Compression coupling--fitting used to join two sections of pipe without threading.

9. Branch--any part of a piping system other than a main.
10. Diameter (plumbing)--nominal commercial measurement as used for piping.
11. Drain--any pipe that carries used water or water born wastes in a building drainage system.
12. Grade--slope of pipe usually expressed as the fall in inches per foot in length of pipe.
13. Main--principal pipe of a water supply or sewer system.
14. Offset--combination of elbows or bends which brings a section of pipe out of direct line.
15. Riser--water supply pipe that extends vertically one full story or more.
16. Plumbing--all the pipes, fixtures and other apparatus that bring in the water supply and remove liquid and water born wastes.
17. Siphonage--a flow of water due to difference in air pressure on the inlet and outlet sides as in a trap.
18. Stack--vertical main of any system of piping.
19. Trap--fitting that allows free passage of wastes but provides a seal of liquid to prevent the return passage of air and gases through it.
20. Vent--pipe installed to provide air within a drainage system to protect trap seals from siphonage and back pressure.

21. Building drain--part of the lowest section of a building drainage system that receives the discharge from all the drainage pipes inside the building and carries it outside to the building sewer.
22. Building main--water supply pipe in the building including fittings from the street main to the first branch of the water distributing system.
23. Building sewer--that part of the building drainage system that extends from the building drain to the street sewer or other place of disposal.
24. Fixture--any receptacle which receives and discharges water, liquid or water born wastes into a drainage system.

2.0 Diagnostic Testing/Plumber

INSTRUCTIONAL OUTCOMES: The Student will complete a Specific Aptitude Test Battery (SATB), administered by a qualified examiner and will have the results explained by a qualified examiner.

INTRODUCTION: The General Aptitude Test Battery is a standardized test that has become recognized as the best validated multiple test battery in existance for use in vocational guidance. The tests are used by apprenticeship committees to assist in the screening process for appropriate candidates when apprenticeship openings occur, and to provide individuals with an indication of the probability of their being successful in a particular trade.

Many apprenticeship programs require applicants to have certain aptitudes as demonstrated by passing appropriate tests. For example, the applicant may be required to pass Specific Aptitude Test Battery (SATB) administered by the State Job Service. SATBs test two or more of the following nine general aptitudes: general learning ability (cognitive functioning), verbal aptitude, numerical aptitude, spatial aptitude, form perception (ability to perceive small detail), clerical perception (ability to distinquish pertinent detail), motor coordination, finger dexterity and manual dexterity.

Each battery tests different combinations of these nine general aptitudes because each occupation requires different specific abilities. The following SATB tests and cutting scores are required by the apprenticeship committee for the trade. The student should be aware of the trade requirements and determine how he or she feels about his or her abilities in the tested aptitudes in order to make a career decision.

PRESENTATION

TEACHING OUTLINE	TEACHING METHODS AND AIDS
2.1 SATB A. Complete exam described below: KEY: Trade Occupation Code # for the occupation SATB for the trade = Recommended cutting	

score for the trade
Location of the SATB within the GATB

PLUMBER S#61R
Numerical Aptitude = 85
Arithmetic Reason; Book II, Part 6
Computation; Book I, Part 3

Spatial Aptitude = 80
Three Dimensional; Book I, Part 3

Clerical Perception = 75
Name Comparison; Book I, Part 1

Manual Dexterity = 80
#9 Place, #10 Turn, Board

	Cutting Scores		
	Adult	Grade 10	Grade 9
Numerical Aptitude	80	75	74
Spatial Aptitude	95	94	91
Manual Dexterity	85	79	76

B. Discuss Results:

3.0 Survival Skills/Plumber

INSTRUCTIONAL OUTCOMES: The student will learn and practice fundamental concepts in: a) dealing with expectations, b) communication skills, c) giving and receiving feedback, d) dealing with interpersonal conflict, e) group problem-solving, goal-setting and decision-making, f) outside influences and responsibilities, g) identifying individual strengths, h) appropriate work habits and attitudes, and, i) phases of job search and worklife.

INTRODUCTION: Training and proficiency in human relations skills are essential for successful adaptation to worklife. All too often in job preparation programs, these basic survival skills are neglected or put aside in favor of training in the technical aspects of work.

This topic describes the many skills necessary to become a stable, productive and satisfied worker.

PRESENTATION

TEACHING OUTLINE	TEACHING METHODS AND AIDS
3.1 Expectations A. Predicting the future 1. Self-fulfilling prophecies a. setting yourself up for failure b. thinking positively	ILS Survival Skills-Expectations PREPARATION Be familiar with the material beforehand, and think up some relevant examples AVAILABILITY Be available to students. Go around those students reading the material. Be prepared to answer and ask questions that increase students' understanding.

	ELICIT RESPONSE Ask individuals what they would like to do most of all. Use their reply even if it seems trite. Suggest two alternative possibilities--the worst and the best. Ask how each would affect that student's feelings and behavior at this moment.
B. Two-step process to opening up expectations. 1. Being idealistic and realistic a. being creative and having ideas	RELEVANT COMPARISONS Illustrate creativity from movies, TV or writing. Tell the beginning of a story and ask for suggestions on how it might end. Give the original writer's version. Show how anything is allowed in creative ideas.
b. keeping close to the facts	Suggest students read court reports or news coverage.
c. effects of leaving out one of the two steps.	STUDENTS' EXAMPLES Encourage extreme examples of fantasy and of sticking close to the facts.
d. combining the two	
C. Prejudice about other groups.	EXAMPLES OF PREJUDICE Show how stereotypes arise out of stereotyped expectations.
D. Being a winner	ROLE MODEL Be heard thinking positively. Encourage positive thinking in students.

E. Self-Assessment--looking at common personal expectations F. Post Assessment	IDENTIFY PROBLEM AREAS Go through questions to see where students are putting themselves down. Give encouragement. Ask what they want to change. EXPLAIN Read through examples, answer questions. FLEXIBILITY Allow students to demonstrate their understanding in less than suggested number of situations.
3.2 Communication Skills A. Good communication 1. two-way process 2. importance 3. innate abilities 4. showing mutual respect B. Active listening. 1. Centering attention on the other person. a. being seen to be listening b. finding out what is important to the other person c. following the other person's lead d. listening to feeling 2. Checking that you have understood what the other person is communicating. a. checking feeling	ILS Survival Skills-Communication Skills. PREPARATION Be familiar with the material. BEING A ROLE MODEL Demonstrate active listening. Ensure that students voice problems and doubts. Allow frequent opportunity for students to give responses to on-going work. Be ready to demonstrate bad examples of listening, to group or individuals, and contrast with good examples.

b. checking content c. when it is inappropriate C. Being listened to. 1. Your rights as an individual 2. When to keep quiet 3. Avoiding being aggressive 4. A three-step approach a. showing you understand b. taking responsibility for your own feelings c. suggesting alternatives D. Overall importance of respect for individuals 1. Communication between equals E. Self-Assessment 1. How individuals communicate with others F. Practicing the skills in triads 1. Active listener of personal experience 2. Role play being listened to	ASSERTIVENESS Draw examples from books on being assertive. Think up appropriate examples in work context. Discuss aggressive responses with individuals. Describe alternative approaches. Discuss possible exceptions--where aggression might be appropriate. INSTRUCTOR/STUDENT RELATIONS Assess relations in class in terms of respect for, and equality of, individuals. Ask students for comments. IDENTIFY PROBLEM AREAS Give help and encouragement. Find out from students what skills they want to practice. TRIADS Form triads (trios) as students finish Self Assessment. FEEDBACK Listen to one example of active listening in each triad. Give suggestions for improvement. Be open to alternative situations for the role play. Ensure students are willing to practice being sensitive to possible reluctance and shyness. Be prepared to role play yourself.

3.3 Giving and receiving feedback A. Importance of being able to give praise and criticism (introduction). B. Importance of group support and teamwork 1. Being a team member 2. Building a team a. knowing where you are b. pulling your weight c. responsibilities for others d. group aims and goals 3. Poor working environments a. indirect communication b. not knowing where you stand C. Reading attitudes 1. Hired or fired? 2. How do you come across to other people? 3. Interpreting other people's behavior D. Giving and receiving positive opinions 1. Importance of praise 2. Taking compliments 3. Giving praise E. Getting and giving criticism 1. Its importance 2. Being criticized 3. Avoiding being threatened 4. Between equals F. Self Assessment-Feelings and Preferences	ILS Survival Skills-Giving and Receiving Feedback PREPARATION Be familiar with the material and prepared to participate actively and equally. FACILITATION Facilitate continuously the building of group support. Give extra support to students who have difficulties participating fully. Enlist help of more confident and verbal to share the responsibility. Give support, but principally be a neutral chairperson or facilitator. Encourage group members to observe each others' non-verbal behavior between class times. POSITIVE REINFORCEMENT Give frequent verbal praise to individuals who are working well and to the group as it becomes more supportive MONITORING Walk around and ask permission to join in some partner discussions. Encourage greater depth. Avoid any judgments. Use paraphrase

	and feeling as checking skills.
G. Assignments 1. Telling individuals what you like	A DEVELOPING PROCESS Introduce when group is ready. First three assignments could be practiced even before module has been read. Explain, in turn each assignment to whole group. Deal with worries, doubts or questions before you begin.
2. Reading attitudes within the group. 3. Opening self-sharing important experiences	Use all your facilitating skills. Especially be sensitive to members' non-verbal responses. Follow up, after the class, on any individual who is upset. At all times encourage positive support within the group. Be prepared to intervene if criticism becomes too negative.
4. Receiving direct positive feedback 5. Receiving direct positive and negative feedback	
H. Post Assessment	Organize small groups or lead discussion of whole group. Use small groups to extend each individual's range of interactions.
3.4 Dealing with interpersonal conflict	ILS Survival Skills-Dealing with Interpersonal Conflict
A. Consequences of poor interpersonal relations	PREPARATION Be familiar with the material and ready to supply further relevant examples from the

	world of work.
B. Recognizing conflict in a work context 1. Open arguments 2. Possible causes 3. Consequences	
C. Them and Us atmosphere 1. The conditions you deserve 2. Whose responsibility?	BE AVAILABLE Encourage students to comment and question points as they arise. Ask them to come up with their own examples, either confirming or disconfirming the information.
D. Unproductive ways of solving conflict 1. Finding someone to blame	
E. Productive ways of solving conflict 1. Taking responsibility for doing something about it a. when people feel threatened by you b. when you feel threatened	RESPONSIBILITY Throughout Survival Skills, individual responsibility is repeatedly stressed. Periodically, reassess your own role. Avoid being pushed into the "expert" stance. Try to be an impartial facilitator, encouraging student's learning without passing judgments. Ensure students take responsibility for what they want to achieve.
F. Remaining passive. 1. Poor working conditions 2. Physiological and psychological problems 3. Irrational fears a. fear of not being liked b. fear of hurting others	
G. Action model for solving interpersonal conflicts 1. Choosing the best time 2. Taking responsibility for your feelings	

3. The four-step language formula. a. tell the other person that what he or she is doing is upsetting you b. speak your feelings c. describe how his or her behavior is affecting you d. suggest an alternative H. Negotiating 1. Give and take 2. Compromise I. Discrimination and prejudice 1. Different types 2. Dealing with it	IDENTIFY IMPORTANT GROUP ISSUES Deal in a neutral manner with examples of discrimination. Ask individuals for personal experience of racial and sexual prejudice and discrimination. Facilitate discussion on Equal Opportunity and Affirmative Actions. Invite solutions to problems from group members.
J. Self Assessment	NEW ISSUES Be aware of any controversial issues that arise during the Self Assessment. Introduce them to the group for general discussion.
K. Assignments 1. Sharing in small groups.	ORGANIZE GROUPS Form groups as students finish writing. Limit talk to five minutes on each topic. Maintain some urgency by announcing the five minute intervals.
L. Post Assessment 1. The formula	COLLECT WORK Read and make encouraging

2. Personal examples	written comments. Arrange contract for completion of work with any students who produce low standard work.
3.5 Group Problem Solving, Goal Setting and Decision-making	ILS Survival Skills-Group Problem Solving, Goal Setting and Decision-Making
A. 10-step model 1. Define the problem 2. Look at the known facts a. what is happening b. who is involved c. when does the problem occur d. where does it occur e. why has it become a problem 3. Agree on your goals 4. Pool ideas for achieving your main goal without evaluating them 5. Look more closely at some of the more interesting and unusual ideas 6. Include any other ideas that you think might be helpful 7. Agree on some guidelines for achieving your goal a. be specific about minimum behavior required 8. Decide on a plan to implement your proposed solutions 9. Assess the likelihood of success 10. Evaluate the success of your decisions after they have been implemented.	PREPARATION AND MATERIALS Know the 10-step model without having to refer to it on the page. Work through the process beforehand. Have photocopies of the model. Have ready one large newsprint pad and one marker for every five students. Choose about six examples of unusual tools or materials that students are unlikely to have seen. Have them ready, but hidden. Get advice from specialists beforehand. AVAILABILITY Go around students in class while they are reading material. Help them understand the 10 steps.
B. Self Assessment	CHECK LACK OF UNDERSTANDING Look over individuals' answers. Give help for misunderstandings.

C. Assignment in small groups 1. Producing quality of ideas 2. Practice in thinking creatively	MATERIALS REQUIRED Sheets of newsprint and sufficient markers ARRANGE GROUPS During these assignments, there may be laughter and a lot of excited talk. Encourage composition of groups on basis of who works well together rather than primary friendships. Keep groups separated by space. Go around groups, sit in and participate. Keep up speed of work by giving limited time to gather ideas. Invite spokesperson from each group to report back on ideas. Write down ideas as they are given and summarize range of proposed solutions.
3. Identifying unusual objects.	OBJECTS REQUIRED Supply one object for each group. Choose trade tools or materials that most students are unlikely to have used.
4. Quality circle	MONITOR PROGRESS Encourage written records of proposed solutions. Ensure all members of each group take some responsibility for finished product. If possible, get results typed out so they can be shared within larger group.

D. Post Assessment	PREPARE HANDOUT Have copies of 10-step model. Make sure students check what they have written and correct it. PERSONAL EVALUATIONS Invite students to read out or tell others what they wrote under 2 in the Post Assessment.
3.6 Wider influences and responsibilities A. Relations with people in authority 1. Formal workplace a. job titles b. hierarchy 2. Informal workplace a. unwritten rules and unstated expectations 3. Showing respect and being relaxed	ILS Survival Skills-Wider Influences and Responsibilities PREPARATION Be familiar with the module and gather useful newspaper cuttings, brochures and leaflets that illustrate the range of possible influences on somebody settling down to work. BE A READY RESOURCE Give examples informally to students from personal experience to back up information. DRAW ON STUDENTS' EXPERIENCE Encourage individuals to think of relevant illustrations from their own experience in a work setting.
B. Relations with family and friends 1. Changes in responsibilities 2. Affects of changes on old relationships a. being prepared b. communicating problems 3. Planning quality time a. keeping work problems at work b. maintaining relationships	

4. Keeping up leisure activities 5. Home problems at work a. leaving problems at home b. serious problems C. Other influences 1. apprenticeship 2. union 3. social organizations 4. other workers 5. state and federal agencies	
D. Self Assessment	SUPERVISION Ask students to show their answers to the Self Assessment. Since it is a test of comprehension, follow up on any difficulties revealed.
E. Assignment	CHOOSING PARTNERS Encourage students to work with someone different each time. After majority of students have completed assignments, hold a report-back session with whole group. Ask students to summarize and draw conclusions from reports given.
F. Post Assessment	DEMONSTRATE Show what is required by illustrating it on a chalkboard.

3.7 Identifying and developing individual strengths A. Evaluating yourself and others 1. Expectations 2. Personal theories a. predicting b. controlling B. Identifying personal values 1. Significant role models 2. Eliciting personal constructs 3. Bi-polar nature of constructs	ILS Survival Skills-Identifying and Developing Individual Strengths PREPARATION Work through module beforehand. Acquaint yourself with any areas that might cause difficulties in understanding. Make extra copies of exercise sheets. Refer to ILS Expectations. AVAILABILITY Be at hand throughout this module. For students to discover significant things about themselves, instructions must be followed closely. Ensure that students have had a personal relationship with each of people listed in right column. Ask them to put names they used to address these people. Check students' understanding of procedure. If necessary, go through method with whole group. Ensure that the description is of importance to each student and not superficial, such as hair color, etc. Stress that there is no correct answer; it is important for each person to write what seems opposite to him or her personally regardless of what anyone else might say.

4. Identifying important personal values	ARRANGE PARTNERS Go around and offer interpretations if requested or encourage students to draw conclusions. Ask what they recognize and what is new.
5. Evaluating yourself. a. as you feel you are b. as you would like to be c. looking at the amount of congruity	DISCUSS WITH INDIVIDUALS OR SMALL GROUPS Be tentative about what is identified. The conclusions can only be significant if the individual finds them significant. Use words and phrases such as..."it seems...," "you may..." "I would guess...." "it might indicate.." Use grid to prompt questions rather than answers.
6. Evaluating significant others a. comparing ratings	IN PARTNERS Suggest each student in turn tries to describe what people the other one might like and what people he or she might not like, based on the constructs on paper. Ensure that students follow instructions closely. Encourage them to search for all influences. If they have difficulty, suggest situations where students make choices, e.g. career, friends, classes, out-of-school activities.
C. Influences on personal decisions 1. How much are you in control of your own life? 2. Positive and negative influences. a. other people b. aspects of self c. organizations	

D. Time management 1. Organizing skills 2. Being responsible for your own life 3. Prime time 4. Making a time chart a. procedure b. interpretation	EXTRA COPIES Have ready prepared extra copies of time chart Ensure agreement on completing time chart. Go over method of calculating actual time. Illustrate on chalkboard or newsprint paper; give example of one day's record. Use tally system. CHECK STUDENTS' UNDERSTANDING Do this before anyone starts recording. It might be advisable to go over procedures one day ahead and practice be done in class.
E. Post Assessment 1. Personal values 2. Influences 3. Use of time	Collect, read and hand back during class. Give encouraging comments.

3.8 Worksite Visits A. Building realistic expectations 1. Questioning job descriptions 2. The human side of the job 3. On-the-job visits 4. Talking with people in the trade B. Group visits 1. Exposure to different working environments 2. Practice in observation 3. Asking questions C. Individual visits 1. After working hours 2. Interviewing the worker 3. Arranging the visit D. Self Assessment-Comprehension E. Assignment 1. Looking at Help Wanted ads	ILS Survival Skills-Finding a Job Worksite Visits PREPARATION Arrange with any company that allows it a group visit during working hours. Have sufficient copies for use by whole class of Help Wanted ads from local newspapers. Become an informed source of possible contacts for student interviews with journeymen and apprentices. CHECK UNDERSTANDING Ensure students comprehend all of the material before making any contacts or visits. HELP WITH ASSIGNMENTS Supply Help Wanted sections--one to each student. Suggest they read through and circle in ink interesting ads. Stress importance that each works on his or her own; it is practice in looking for jobs. Collect what students write and report back

	to whole group with summary of students findings.
2. Writing realistic job descriptions.	Read and comment on students' descriptions. With individual's permission, read out selection to whole group and invite comparisons with job descriptions in newspaper.
3. Contacting a journeyman or apprentice	Supply names and encourage students to come up with own contacts. If necessary, two students could team up to make a visit. Role play telephone contact and get students to copy out suggested questions. Make individual contract with each student, setting deadlines to call, to visit and to report back. Check on progress and share with rest of group.
4. Asking questions	Arrange for individuals to report back to whole group at same session.
5. Making a group visit	Go over observations and questions beforehand. Ask students to write questions down. Divide questions, and order of asking, among group. Add any other questions suggested by group.
6. Reporting back	Ensure that each student records his or her observations. Invite individuals to report on their feelings and findings.
7. Discussion	Lead group discussion on overall findings.

	Arrange another worksite visit.
3.9 Resumes A. Nature and function 1. Self advertisement 2. Summary of strengths and skills 3. Different ways to use resumes 4. Contrast application forms B. Extracts from resumes 1. People with little work experience 2. Presenting the best interpretation of the facts C. Suggested format 1. Position desired a. finding out about the job b. matching your skills 2. Education 3. Relevant work experience 4. Other relevant experience 5. Personal data 6. References a. making a list of your achievements D. Identification of your skills 1. Personal and interpersonal skills 2. Skills used in leisure and work activities a. what could go wrong b. what skills you need to avoid mistakes c. stamp collecting d. planting a garden E. A professional finish 1. Typing 2. Paper	ILS Survivial Skills-Finding a Job-Resumes PREPARATION AND MATERIALS Large pad of newsprint and sufficient markers for group. Ensure that there are adequate flat surfaces.

2. Writing a draft resume	separate. Give encouragement and direct help with drafting of resume. Take best draft, type it and duplicate it on quality colored paper. With permission of student, share with whole group. Encourage sharing of draft resumes. Offer to help later if individuals want to develop a finished version of resume.

F. Cover letter 1. Why them? 2. Why you? 3. Let's meet G. Self Assessment 1. Personal and interpersonal skills	HELPING WITH ASSIGNMENTS Be available throughout, when students are working on Self and Post Assessment. Write on chalkboard further suggestions of personal and interpersonal skills.
2. In a job context	Suggest students help each other in finding relevant examples of their application of skills.
3. Analyze three examples of work	Allow partners to choose each other. Emphasize broad definition of work to include paid and unpaid, part-time, etc. Give examples. Model how students can help each other. Go around and ask questions to elicit relevant information.
H. Post Assessment 1. Organizing personal work experience	Supply sheets of newsprint and markers. Tell students to use the full area of paper. Check that students are recording all the suggested information. Inspect sheets individually and suggest best way to organize data. Advise on where to include or omit dates and which experience to group or

3.10 Interviews

A. Subjective nature of interviews
   1. Content of hiring interviews
   2. Interviewers' opinions
   3. Interviewees' opinions

B. Facts and opinions
   1. Giving honest opinions
   2. Interpreting facts
   3. Quoting references and examples
   4. Deciding what is relevant

C. Employers' expectations
   1. Objective measures of aptitude and achievement
   2. Appropriate attitudes and work habits

D. How to communicate interest and enthusiasm
   1. Be genuine
   2. Be informed
   3. Showing enthusiasm
      a. non-verbally
      b. how to speak and what to say

E. How to communicate that you will be a good worker
   1. Finding examples

F. How to show you are trainable
   1. School and non-school

G. How to show you work well with people
   1. Relations with the interviewer
   2. Giving examples

H. How to be realistic about what you want
   1. Knowledge of the work environment
   2. Knowledge of the career structure
   3. Answering questions about goals

ILS Survival Skills-Finding a Job-Interviews

PREPARATION AND MATERIALS

Read material beforehand and recall examples from own experience. Have two copies of observers' checklist for each student.

I. Appearance
  1. Clothes
  2. Grooming

J. Non-verbal behavior
  1. Punctuality
  2. Nervousness
  3. Body posture
  4. Gestures
  5. Smoking and chewing

K. Being positive
  1. About yourself
  2. About others

L. Self Assessment
  1. Role play
    a. interviewer
    b. interviewee
    c. observer
  2. List of questions
  3. Checklist

M. Post Assessment
  1. Interview in front of the group
  2. Questions from Joint Apprenticeship Committee
  3. Giving positive feedback

FORM TRIADS

Go through checklist to ensure understanding. Choose best working groups. Keep it moving by limiting time for each role play. Be willing to model positive answers in interviewee's role.

Ask for a volunteer, then allow him or her to select next interviewee. Suggest use of observer's checklist, plus any other positive comments. Give feedback from group and yourself, immediately after each interview. Invite interviewee to share his or her feelings experienced during role play.

3.11 Appropriate work habits and attitudes A. Surviving on the job. 1. Keeping informed	ILS Survival Skills-Finding a Job -Appropriate Work Habits and Attitudes BE A RESOURCE Share personal experience with individuals. Encourage students to ask any older people about work habits and attitudes. Give time for sharing students' findings.
B. Employer's expectations 1. Being punctual and dependable 2. Being honest 3. Being loyal 4. Being willing to learn and able to take criticism	Show relevance of previous modules to both 2 and 3. Ask individuals what expectations a member of Survival Skills class has.
C. Expectations of fellow workers 1. Proving your competence 2. Being reliable and dependable 3. Being a learner 4. Being enthusiastic and interested 5. Being honest and loyal	POSSIBLE DISCUSSION What do individuals expect of friends? What are peer group's attitudes toward 4?
D. Proving your competence to your supervisor 1. High standard of work 2. Keeping a written record of your achievements 3. Showing initiative 4. Taking on responsibility 5. Asking for help	
E. Interference of personal habits 1. Substance abuse 2. Seeking help	Be sensitive to possibility of substance abuse affecting student performance. Learn physical indicators; have referral addresses available.

F. Self Assessment

G. Post Assessment

Check comprehension.
Tell students to repeat reading and doing Post Assessment until acceptable standard is reached.
Discuss with individuals any disagreements over appropriate answers and be flexible.

SUGGESTED READINGS:

Alberti, R.E. and Emmons, M.
Your Perfect Right
Impact, 1974.

Blicq, Ron
On the Move: Communication for Employees
Prentice-Hall, 1976

Bolles, Richard N.
The Three Boxes of Life
Ten Speed Press, 1978

Fast, Julius
Body Language
Pocket Books, 1971

Chapman, Elwood N.
Your Attitude is Showing: A Primer on Human Relations
Science Research Associates, 1972

Ford, George A.
Planning your Future: A workbook for Personal Goal Setting
University Associates, 1976

McCay, James T.
The Management of Time
Prentice-Hall, 1977

Nelson, Robert E.
Decision Making
Vision Publishing, 1976

Peale, Norman V.
The Power of Positive Thinking
Prentice-Hall, 1952.

4.0 Trade Math

INSTRUCTIONAL OUTCOMES: The student will complete a diagnostic examination to determine his or her level of math competency, and will receive instruction in those areas of mathematics in which he or she experiences difficulty.

INTRODUCTION: People in every apprenticeable occupation routinely use mathematics in their work. The skilled worker who can perform fast and accurate math calculations can work quickly and efficiently.

PRESENTATION

TEACHING OUTLINE	TEACHING METHODS AND AIDS
4.1 Math Diagnosis A. Used to test skills 1. Math diagnostic exam, attached, or other suitable exam.	Explain "placement exam" concept Administer exam Grade performance
4.2 Math Remedial A. Used to upgrade skills 1. Modules, as listed, improve performance levels.	Assist student to achieve performance level

ILS	Math--Linear Measurement	
ILS	Math--Whole Numbers Addition Subtraction Multiplication Division	
ILS	Math--Addition & Subtraction of common fractions and mixed numbers	
ILS	Math--Multiplication & Division of common fractions and whole and mixed numbers	
ILS	Math--Compound numbers	
ILS	Math--Percent	
ILS	Math--Ratio and Proportion	
ILS	Math--Decimals Addition Subtraction Multiplication Division	
ILS	Math--Perimeters Areas and Volumes	
ILS	Math--Circumference and Area of Circles	
ILS	Math--Areas of Plane Figures, Volumes of Solid Figures	
ILS	Math--Metrics	

4.0 Trade Math Diagnosis
Placement Test

Name _____

Date _____

1.

Read the distance from the start of the ruler to the letters A through O to the nearest 1/32".

A= _____ F= _____ K= _____

B= _____ G= _____ L= _____

C= _____ H= _____ M= _____

D= _____ I= _____ N= _____

E= _____ J= _____ O= _____

2.

686 + 240 + 1,320 + 16 + 400 =

40 - 16 =

292 X 16 =

180 ÷ 5 =

A contractor buys 400 sacks of rock for three different jobs. On the first job he uses 78 sacks; on the second, 85 sacks; and on the third, 205 sacks. How many sacks does he have left?

A contractor's bid on a school building is $78,265. When one wing is omitted to cut costs, he is able to cut his bid by $16,228. What is his new figure?

3.

If a bundle of rock lath weighs 35 lbs. and it is permissible to place 700 lbs. on any one area on a floor, how many bundles can be placed on any one area?

If 5 lbs. of putty are required to install one light of glass, how many lights can be installed with 85 lbs.?

4.

The improper fraction 48/32 expressed as a mixed number is:

The mixed number 4 3/8 expressed as an improper fraction is:

What is the least common denominator for the following group of fractions: 1/8, 1/2, 1/4, and 1/12?

What is the sum of the following fractions: 7/8, 3/4, and 9/16?

If 3/4 is subtracted from 11/12, the difference is:

The sum of 1 5/8, 2 11/64, and 19 1/4 is:

5.

One roof is 1/3 larger in area than another. The smaller roof takes 24 squares of roofing material. How many squares of roofing material will the larger roof take?

One-third of a box of glass is needed to glaze the north elevation of a building; 2/3 of a box is needed to glaze the south elevation; 1/16 of a box is needed to glaze the east elevation; and 1/2 of a box is needed to glaze the west elevation. How many boxes are needed to glaze all four elevations?

From a bundle containing 101 linear feet of molding, a cabinetmaker uses the following amounts: 11 1/3', 8 3/4', 12 1/8', and 9 5/8'. How many linear feet of molding does he use in all?

6.

The product of 1/2 X 7/8 is:

The quotient of 1/4 ÷ 1/3 is:

If a roll of carpet weighs 467 1/2 lbs. and a running foot of the carpet weighs 2 1/8 lbs., how many running feet are in the roll?

A piece of pipe must be cut to 3/8 the length of another pipe, which is 9' long. How long a piece must be cut?

7.

Write each of the following as decimals.

Seven tenths

Sixteen hundredths

Fifteen thousandths

Eleven ten-thousandths

Two thousand one hundred fifty-two thousandths

Convert each of the following measurements to feet in decimals.

4' 6"

2' 4 1/4"

A house with a floor area of 1,860 sq. ft. is estimated to cost $18,042. What is the cost per square foot?

A stack of plastic sheets measures 2.28" thick, and it is known that the sheets average 0.06" in thickness. How many sheets are in the stack?

8.

The labor cost for the concrete work for a house was $248. The material cost $210. What percent of the total cost of the concrete work was for material?

An architect indicates a 1/8" = 1'0" scale in the drawing of a swimming pool. What is this scale expressed as a ratio?

On a tile job in which fireclay is to be used, a tilesetter tells his helper to mix mortar according to the following formula: 6 buckets of river sand, 1 bucket of fireclay, and 2 buckets of cement. What is the ratio of sand to fireclay in the mixture?

9.

Divide 19' 2" by 3' 10".

How many pieces of 2' 3"-wide gypsum lath will be needed to cover a wall 48' 6" long?

10.

What is the perimeter of a room 20' wide and 30' long?

What is the area, in square feet, of a floor 42' by 42'?

How many cubic yards of dirt have been removed for the basement and foundations of a house if the excavation is 35' long, 35' wide, and averages 5' deep?

The area of a circular putting green with a radius of 17' is how many square feet?

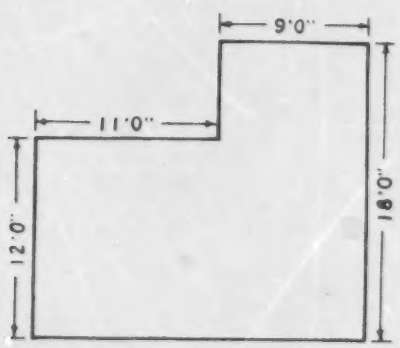
What is the area of a circular floor with a diameter of 10' 6", to the nearest square foot?

What is the area, in square inches, of an acute triangle with a base of 8 1/2' and an altitude of 11 1/4"?

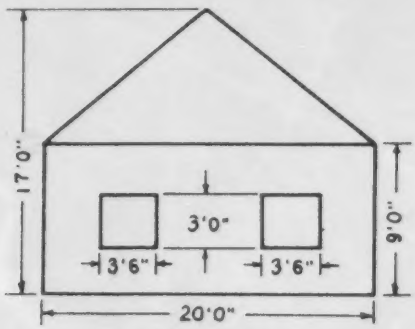
What is the area in square feet, of the floor shown below?

How many cubic yards of concrete will be needed for the foundation walls and footings in the plan below if the walls are 6" thick and 18" deep, and if the footings (shown in dotted lines) will require 2 5/27 cu. yd. of concrete?

1. 6
2. 6 2/3
3. 7
4. 7 1/6



What is the total area, in square feet, of the exterior wall and gable shown below, excluding window areas?



11. Metrics

3 inches	=	cm
5.4 inches	=	cm
7 feet	=	m
3.2 feet	=	m
6.5 yards	=	m
15.3 m	=	inches
12.7 cm	=	inches
50.8 mm	=	inches

5.0 Physical Requirements/Plumbing

INSTRUCTIONAL OUTCOMES: The student will demonstrate knowledge of physical requirements of the trade and the processes of physical development.

INTRODUCTION: The trade requires certain physical skills and abilities of the worker. It is necessary that the student be aware of the physical demands of the trade and understand factors of physical development.

PRESENTATION

TEACHING OUTLINE	TEACHING METHODS AND AIDS
5.1 Physical Requirements A. Strength 1. Lifting. a. equipment and materials weighing 20 to 100 lbs. 2. Carrying. a. equipment and material weighing 10 to 100 lbs. 3. Pushing. a. material placement (e.g. tub/ shower units). 4. Pulling. a. removing material (e.g. existing fixture).	On-site visit or classroom simulation. A. Demonstrate B. Lead discussion or question on job site C. Discuss proper technique D. Administer work sheet

B. Balance
   1. Climbing.
      a. while on ladders for overhead work.
   2. Balancing.
      a. while carrying long pipe stock.

C. Body Dexterity
   1. Stooping.
      a. reaching for shut off valves, etc.
   2. Kneeling.
      a. low work (e.g. under sinks).
   3. Crouching.
      a. work in confined space (e.g. crawlspace).
   4. Crawling.
      a. moving to worksite in crawlspace.
   5. Reclining.
      a. working in confined space where clearance dictates.

D. Manual Dexterity
   1. Reaching above shoulder.
      a. overhead work.
   2. Reaching below shoulder.
      a. access to shut off valves.
   3. Handling.
      a. gripping tools (e.g. wrenches).
   4. Fingering.
      a. manipulating fittings/couplings.
   5. Feeling.
      a. alignment of pipes/fittings in blind spots.

E. Talking

1. Normal communications.

F. Hearing

1. Normal communications.

G. Vision

1. Normal vision.
    a. moving about jobsite.
2. Acuity near.
    a. checking for leaks.
3. Field vision.
    a. moving long pipe stock on job.

H. Coordination

1. Hand-arm.
    a. using wrenches, pipe threaders.

PHYSICAL ACTIVITIES PRESENT IN THE TRADE: REQUIREMENTS (to be completed by student)

STRENGTH	Weight	Frequency	BODY DEXTERITY	Degree of Activ.	Frequency	MANUAL DEXTERITY	Degree of Activ.	Frequency
Lifting			Stooping			Reaching-above shoulder		
Carrying			Kneeling			Reaching-below shoulder		
Pushing			Crouching			Handling		
Pulling			Crawling			Fingering		
BALANCE	Need	Frequency	Standing			Feeling		
Climbing			Sitting			TALKING (speech)		Frequency
Balancing			Walking			HEARING	Acuity	Range
VISION	Need	Frequency	Reclining			COORDINATION	Degree	Frequency
Normal vision			VISION (Cont'd)			Hand-arm		
Acuity-near			Color vision			Foot-leg		
Acuity-far			Field of vision			Eye-Hand-Foot		
Depth perception								

5.2 Individual Developmental Processes A. Maturation 1. Causes physical changes in height and body proportion. 2. Causes emotional changes. 3. A gradual process. 4. Fluctuates from person to person. B. Nutrition 1. Vital to normal growth and development. 2. Essential food groups. a. dairy products. b. meat. c. vegetables and fruits. d. bread and cereals. C. Personal Care and Exercise 1. Good grooming habits. 2. Sufficient sleep and relaxation. a. fatigue increases chances for accidents. 3. Hobbies. a. source of relaxation, help to maintain good attitude. 4. Daily exercise. a. stimulates interest. b. relieves stress. D. Substance Abuse 1. Marijuana. a. affects nervous system. b. affects thinking, judgment and coordination. c. long-term effects unknown.	ILS Physical Development Explanation and Discussion Invite Specialist

2. LSD. a. affects chemical level in brain. b. produces bizarre mental reactions. 3. Barbiturates. a. one of most commonly abused drugs. b. slow responses. c. physically addicting. d. long-term use causes personality disorders. 4. Amphetamines. a. affect central nervous system. b. commonly abused. c. cause psychological dependence. d. dull emotions and impair ability to make decisions. 5. Alcohol. a. psychologically addicting.	
E. Meeting Various Trade Requirements 1. Recognize and prepare. a. natural maturation processes may play role. b. exercise will play role.	On-job-site visitations and consultation with occupational therapist.

6.0 Safety

INSTRUCTIONAL OUTCOMES: The student will be able to identify those hazards, acts and conditions which affect safety on the job and will be able to identify ways to avoid or correct them.

INTRODUCTION: A good worker is a safe worker; injury affects production, as well as the ability of a person to earn a living.

PRESENTATION

TEACHING OUTLINE	TEACHING METHODS AND AIDS
6.1 General Safety A. Average--over 14,000 employees killed each of past several years. 1. From 1960 to 1970 over 150,000 fatalities. 2. Cost, excluding property damage, $11.5 billion. 3. 50 million employee days lost in 1972. B. Accidents 1. An unplanned and unforeseen occurrence that interferes with or interrupts orderly progress of activity.	Explain, Discuss and Demonstrate Where Appropriate ILS General Safety

2. Should be analyzed to determine why and how happened. a. unsafe conditions; poor or defective equipment, poor housekeeping, inadequate lighting. b. unsafe acts; loose-fitting clothing; horseplay, removing guards. C. OSHA 1. Williams-Steiger Occupational Safety and Health Act, 1970. 2. Requires employers to provide safe conditions. 3. Requires employees to comply. 4. Covers about 60-million people; excludes federal employees.	
6.2 Personal Safety A. Safety Consciousness 1. Be aware of good safety practices. a. learn the rules. B. Safety Awareness 1. Put safety consciousness to use. a. obey the rules. C. Head Protection 1. 130,000 head injuries in 1976. 2. Wear clean, adjustable hard hat. D. Eye and Face Protection 1. 1,000 eye injuries each day. 2. Wear safety glasses, goggles, masks; shields if near harsh chemicals. 3. Wear safety glasses under shields.	ILS Occupational Safety-- Personal Safety

E. Hearing Protection
   1. Ear inserts lower high frequency.
   2. Ear muffs lower low frequency.

F. Lung Protection
   1. Mechanical filters protect against non-toxic dust.
   2. Chemical-cartridge types protect against low concentration of some vapors.
   3. Gas masks protect against organic vapers and toxic gases for limited time.
   4. Supplied-air respirators protect against high concentrations of gases and fumes.
   5. Self-contained breathing apparatus protects against high concentrations of gases, vapors, dusts, etc.
   6. Air line respirators protect against high concentrations of dusts, fumes, mists, and low concentrations of gases.
   7. Select proper one for each job.

G. Hand Protection
   1. Average of over 1,300 disabling hand and finger injuries each day in 1976.
   2. Gloves.
      a. asbestos protects against thermal burns, hot or cold.
      b. metal mesh protects against cuts and sharp objects.
      c. rubber protects against electrical and chemical burns.

d. neoprene and vinyl protect against chemicals. e. leather protects against rough objects, heat and sparks. f. fabric protects against dirt, abrasions, slivers. g. coated fabrics protect against chemicals. 3. Creams also used. H. Foot Protection 1. Over 200,000 disabling foot and toe injuries each year. 2. Wear leather steel-toed safety shoes or boots.	
6.3 Fire Types and Prevention A. Fire Types 1. "Class A" of wood, cloth, paper. 2. "Class B" of liquids and gases, paint, grease. 3. "Class C" of energized electrical equipment. 4. "Class D" of metals or metallic dusts. B. Methods of Extinguishing 1. Absorb heat--add water. 2. Smother--add dry chemicals, foam. 3. Remove fuel--shut off supply. C. Fighting Classes of Fires 1. Class A a. water to cool heat.	ILS Fire Types and Prevention

2. Class B. a. CO_2, powder to smother fire. 3. Class C. a. non-conducting agent. b. attempt to de-energize. 4. Class D. a. special extinguishing agent for types of metals.	
6.4 Hygiene Safety A. Exposure to Toxic Materials 1. Can create health hazards. 2. Internal exposure. a. breathing contaminants. b. swallowing contaminants. c. absorption through skin. 3. External exposure. a. contact with skin. b. can affect senses. B. Noise Pollution 1. Measured in decibels. 2. Can affect hearing over period of time. 3. Affects other parts of body. a. changes size of blood vessels, makes heart work faster. b. produces headaches. c. negatively affects nerves, decreases powers of judgment.	ILS Occupational Safety--Hygiene Safety

C. Airborne Contaminants

1. Dusts; particles generated mechanically.
   a. can affect skin, eyes, lungs.
2. Fumes; solid particles of condensation process.
   a. common fumes caused by oxidation of metal.
3. Mists; particles of liquids or liquids and solids.
4. Gases; low density, change to liquids or solids.
5. Vapors; gases normally in solid or liquid state at room temperature.
6. Contaminants may affect body in four ways.
   a. as irritants to lungs.
   b. as asphyxiants, prevent blood from normal transfer of oxygen.
   c. as anesthetics or narcotics, cause drowsiness and nausea.
   d. as systemic poisons, attack vital organs.

6.5 Hand Tool Safety

A. Hammers

1. Face should be 3/8" larger in diameter than object.
2. Strike object squarely and flatly.
3. Replace damaged handles before use.
4. Don't strike wood- or plastic-handled chisels.
5. Don't pound with cheek (side) of hammer.

ILS Occupational Safety--Hand Tools

6. Don't pound sharp objects with mallets

B. Chisels, Punches, Nail Sets
   1. Be sure tools are ground at proper angles.
   2. Remove mushroomed heads.
   3. Hold tools with tongs if being struck by another worker.

C. Screwdrivers
   1. Select correct size and tip style.
   2. Don't pound on screwdrivers.
   3. Don't put hands and fingers under work.
   4. Don't use screwdrivers to pry.
   5. Use appropriate wrench on square-shank screwdriver.
   6. Use magnetized screwdriver to start screws in awkward places.
   7. Use non-sparking screwdrivers if working near explosive hazard.
   8. Use insulated screwdrivers when working on electrical devices.
   9. Don't use screwdriver for electrical testing.

D. Wrenches
   1. Select correct type for job.
   2. Select correct size for snug fit.
   3. Don't use cheater bars.
   4. When using adjustable wrenches, always pull, always against fixed jaw.
   5. Be sure wrench fits squarely, not tilted.
   6. Don't pound with a wrench.

7. Use penetrating oil on "frozen" objects.

E. Pliers
   1. Select correct size and type.
   2. Don't use cheater.
   3. Excessive heat will draw temper from metal.
   4. Don't pound with pliers.
   5. Cutting pliers.
      a. cut at right angle to wire.
      b. point open side down so cut end will not fly out.
   6. Use pliers with high dielectric insulation when working on electrical devices.
   7. Keep jaws clean.

F. Vises
   1. Work as close to vise as possible.
   2. Clamp objects in middle of jaws.
   3. Don't use cheater bar.
   4. Use adequate-sized vise.
   5. Support far end(s) of long work to avoid putting excess strain on vise.

G. Clamping Tools
   1. Select correct size and type.
   2. Keep moving parts clean and lightly-oiled.
   3. Don't over-tighten.
   4. Don't use cheater.
   5. Don't use for hoisting materials.

H. Saws

1. Select correct size and type.
2. Maintain sharpness.
3. Check material before sawing.
4. Use sawhorse or bench, not knee, when sawing.
5. Make sure handle is clean and tight.
6. Be aware of hand, finger and leg position before sawing.
7. Hacksaw teeth should point away from handle to saw on push stroke.
8. Wear gloves when sawing metal.

I. Snips, Shears

1. Select correct size and type.
2. Keep blades sharp.
3. Do not cut wire.
4. Use only hand pressure.
5. Wear gloves.

J. Files, Rasps

1. Select proper size and type.
2. Don't use wood file or rasp on metal.
3. Cut on forward stroke.
4. Keep teeth clean.
5. Use proper sized handles.
6. Don't use to pry.

6.6 Power Tools

A. Circular Saws

1. Operate only with fixed guard on upper half of blade and flexible guard on lower half; don't tamper with guards.

ILS Occupational Safety--Power Tools

2. Blade should clear material by maximum 1/8".
3. Operate by not forcing; forward motion only.
4. Check material for nails, grit, etc.; support material so it doesn't bind.
5. Allow blade to come to full speed before cutting; prevents kickback.
6. Make sure lower guard has returned before setting down.
7. Clean sawdust from lower guard often.

B. Sabre Saws
1. Select proper blade for material.
2. Feed blade slowly.
3. Hold saw base against material.

C. Pneumatic Tools
1. Secure all hoses.
2. Clean with compressed air only if less than 30 PSI with guard.
3. Hoses over 1/2" diameter must have safety valve at source.
4. Hose couplings must have safety connection.
5. Nailers should have device to prevent ejecting when not in contact with work.
6. Point tools toward floor when carrying.
7. Shut down, turn off air supply, bleed line.
8. Wear safety equipment, goggles, shields, etc.

D. Hydraulic Power Tools

1. Fluid used must be fire-resistant and approved by U.S. Bureau of Mines.
2. Don't exceed manufacturer's pressure recommendations.
3. Don't touch stream of fluid from leak.

E. Compressors

1. Storage tanks must be approved by American Society of Mechanical Engineers.
2. Drain condensed water daily.
3. Tanks must have safety relief valve.
4. Pressure gauge must be maintained accurately.

F. Powder-Actuated Tools.

1. Test before loading each day.
2. Load just before using.
3. Wear hearing, eye protection.
4. Don't point at anyone; keep hands away from barrel end.
5. Leave protective guards in place.
6. Must have safety device to prevent accidental firing, and to prevent firing if tilted.
7. Don't operate near combustion hazard.
8. Should only be operated by trained and qualified personnel.
9. Return tool to case after use.
10. Don't drive fasteners into extremely hard or brittle materials.

7.0 First Aid

INSTRUCTIONAL OUTCOMES: The student will successfully complete an eight-hour multi-media first aid class, taught by a qualified instructor, and will obtain a First Aid Card.

INTRODUCTION: Persons employed in any occupation, especially those occupations which deal with power and hand tools, encounter situations when first aid may be necessary to prevent an injury from becoming more serious. A first aid course, successfully completed, prepares individuals to cope with many of those situations.

PRESENTATION

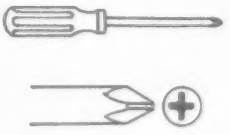
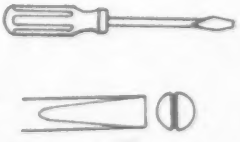
TEACHING OUTLINE	TEACHING METHODS AND AIDS
7.1 First Aid A. Eight-hour multi-media course, or equivalent, offered by: 1. Red Cross 2. Medical Services, Inc. 3. Police Department 4. Fire Department 5. Other service and health organizations.	Administer course

8.0 Trade Tools/Plumber

INSTRUCTIONAL OUTCOMES: The student will be able to identify, select and explain the use of commonly-used trade tools, as well as to demonstrate basic proficiency in their use.

INTRODUCTION: The skilled worker, in order to master the trade and accomplish the work tasks efficiently and effectively, needs an understanding of the tools and their proper use.

PRESENTATION

TEACHING OUTLINE	TEACHING METHODS AND AIDS
8.1 General Tools A. Phillips Screwdriver 1. A shank of metal with a pointed cross tip at one end and a handle at the other end. 2. Used to tighten or loosen screws. 3. Tighten or loosen screws: determine appropriate size of screwdriver to match size of slots in screw head; grasp screwdriver handle in one hand and place point in slots of screw head. Turn clockwise to tighten screw or turn counter-clockwise to loosen screw.	Demonstrate and Explain ILS Holding and Fastening Tools  Phillips Screwdriver  Blade Screwdriver

B. Standard Slot Screwdriver

1. A shank of metal with a flat tip at one end and a handle at the other end.
2. Used to tighten or loosen screws.
3. Tighten or loosen screws: determine appropriate size of screwdriver to match size of slot in screw head. Grasp screwdriver handle in one hand and place blade in slot of screw. Turn clockwise to tighten screw or turn counter-clockwise to loosen screw.

C. Offset Screwdriver

1. A shank of metal with each end offset 90^{o} from its length; a screwdriver tip is formed on the ends of the offsets; these are made with standard slot head or phillips head tips.
2. Used to tighten or loosen screws in close areas.
3. Tighten or loosen screws: insert appropriate tip into screw and pull clockwise to tighten screw. Pull counter-clockwise to loosen screw.

D. Propane Torch

1. Use: soldering copper pipe and fittings.
2. Assembly.
   a. tank.
   b. tank wrench.
   c. regulator.
   d. hose.
   e. torch--assorted tips.
   f. striker.

Torch

Striker

3. Process: soldering copper pipe and fittings.
   a. clean pipe.
   b. clean fitting.
   c. apply flux to fitting.
   d. apply flux to pipe.
   e. insert pipe into fitting.
   f. heat fitting with torch.
   g. apply solder to joint.

E. Cast Iron Pipe Cutter (snap cutters)

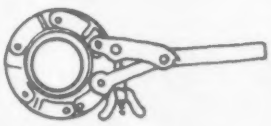
ILS PL-RI-OIC

1. A scissor like tool with cutting wheels in a chain at one end.
2. Used to cut cast iron pipe.
3. Cut cast iron: spread open handles of cutter, place cutting wheel chain around pipe, lock chain in place and adjust nut clockwise for a snug fit; apply pressure on handles to cut pipe.

F. Pipe Die
   1. Component pieces of hardened steel within a die stock with handle.
   2. Used in threading pipe.
   3. Threading pipe: With pipe secured in pipe vise select appropriate die to match pipe size. Insert pipe into die stock and pull clockwise to run threads, pull counter-clockwise to remove die stock from pipe. Use cutting oil during cutting only. Ream pipe as last operation; see "pipe reamer."

G. Steel Pipe Cutter

1. A clamp like device with rollers and an adjustable cutting wheel.
2. Used to cut steel pipe.
3. Cutting pipe: Mark pipe where cut is desired; open pipe cutter by turning wheel handle on end counter-clockwise. Place pipe cutter around pipe centered on mark, turn wheel handle clockwise until cutting wheel touches pipe. Grasp handle and revolve pipe cutter around pipe two turns; turn wheel handle clockwise again. Repeat until pipe is cut through.

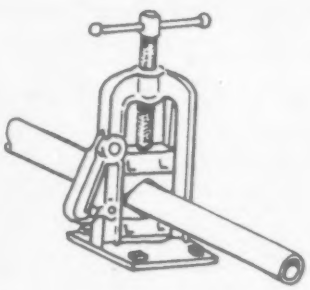


H. Steel Pipe Reamer

1. A pointed shank of steel with sharp edges and a handle.
2. Used for reaming pipe.
3. Reaming pipe: with pipe secure in pipe vise and after threading, grasp reamer firmly and insert in end of pipe. Push in and turn reamer clockwise to ream pipe; withdraw reamer when complete.

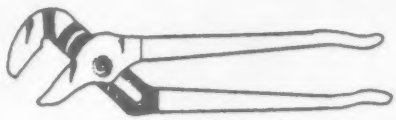
I. Pipe Vise

1. A clamping device of metal with a toothed jaw and an interlocking chain.
2. Used to hold pipe for cutting and threading.
3. Hold pipe for cutting threading: lay pipe in toothed jaw with appropriate length beyond vise; loosen chain at handle; place chain in slot and tighten handle clockwise.



J. Slip Groove Pliers

1. An adjustable plier with opposing jaws having teeth (channellock).
2. Used for gripping pipe and internally threaded fittings.
3. Gripping pipe and internally threaded fittings: adjust jaws by aligning "groove" to appropriate fitting size. With one hand place plier over pipe and squeeze handles together while pulling clockwise to tighten internally threaded fitting onto pipe or pulling counter-clockwise to loosen internally threaded fitting.



K. Open End Wrench

1. A metal wrench with an opening at each end corresponding to various sizes of bolts and nuts.
2. Used to tighten or loosen bolts and nuts.
3. Tighten or loosen bolts or nuts: place wrench of appropriate size on head of bolt or nut. With one hand pull clockwise to tighten bolt or nut or pull counter-clockwise to loosen bolt or nut.

L. Keyhole Saw (Compass)

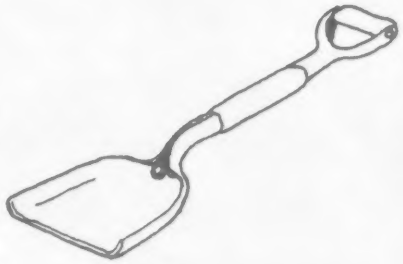
1. A thin tapered metal blade with sharp toothed edge and handle at one end.
2. Used to cut or enlarge holes in floors or walls.

ILS PL-FI-II

3. Cut or enlarge holes in wall or floors: grasp handle firmly and place tapered end of saw in hole to be enlarged; move saw forward using even, smooth strokes.

M. Shovel

1. A long wooden handle with a large thin piece of metal affixed to one end.
2. Used for digging.
3. Hold handle with two hands, place metal on ground. Push down on metal top edge with shoe; withdraw shovel while moving handle down and lifting metal end to retain dirt on shovel.

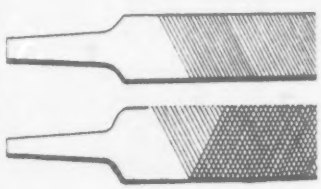


N. Flat File

1. A hardened shank of steel with ridged surfaces having a handle at one end.
2. Used for smoothing surfaces.
3. Smoothing metal or wood surfaces: grasp handle firmly and place file on surfaces to be smoothed; push forward and down evenly.

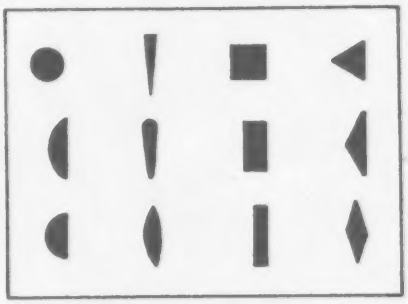
O. Round File

1. A hardened round shank of steel with ridged surfaces having a handle at one end.
2. Used for smoothing concave surfaces or reaming holes.
3. Smoothing concave surfaces or reaming holes: grasp handle firmly and place file on surface to be worked; push forward and down evenly.



P. Triangular File

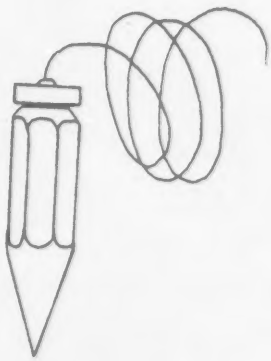
1. A hardened triangular shank of steel with ridged surfaces having a handle at one end.
2. Used for smoothing surfaces or removing metal between grooved edges.
3. Smoothing surfaces or removing metal between grooved edges: grasp handle firmly and place file on surface to be worked. Push forward and down evenly.



File Sections

Q. Plumb Bob

1. A pendant-like pointed object suspended by string or cord.
2. Used for marking lines as being plumb with two points at different elevations.
3. Marking lines: line up string at upper mark or location and scribe mark at point of bob at lower elevation.



R. Ball Peen Hammer

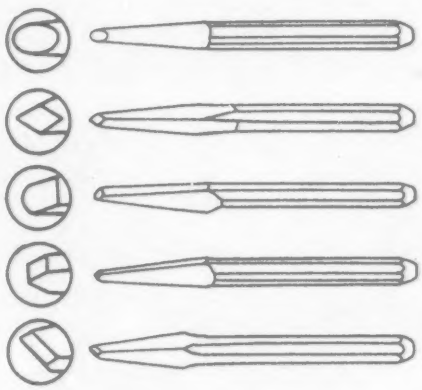
1. A wooden handle with metal affixed to one end; designed to strike metal objects.
2. Used for:
   a. metal shaping.
   b. striking metal chisels or punches.
3. Metal shaping: hold handle firmly in one hand; with smooth even blows strike material to be shaped.

4. Striking metal chisels or punches: hold chisel or punch with one hand; with the other hand hold the hammer handle firmly with the flat surface facing the chisel or punch. With smooth even blows, strike the top end of the chisel or punch while bending the elbow.

S. Cold Chisel

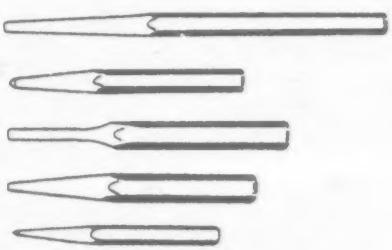
1. A hexagonal shank of steel with a blade at one end and flat at the other for striking with a hammer.
2. Used for
   a. cutting metal.
   b. cutting cast iron pipe.
3. Cutting metal: hold the chisel in one hand and place on metal to be cut. Strike end of chisel with measured blows.
4. Mark pipe to be cut all the way around. Place chisel on mark and strike end of chisel with hammer. Move to next spot on mark and repeat. Continue until pipe is cut through.

ILS PL-RI-OIC



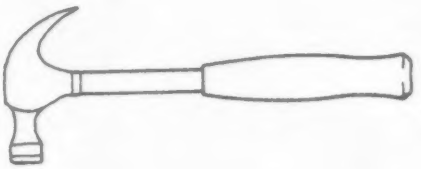
T. Center Punch

1. A shank of steel with a point at one end and square at the other for striking with a hammer.
2. Used to mark metal surfaces for drilling.
3. To mark metal surface: place point on desired spot; and strike the square end with a ball peen hammer.



U. Claw Hammer

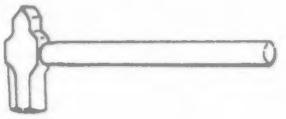
1. A wooden handle with metal affixed to one end, designed to pound or pull nails.
2. Used to
   a. pound nail.
   b. pull nail.
3. Pound nail: hold handle firmly in one hand with hammer head facing away from you. With smooth even blows, strike nail head while bending elbow.
4. Remove nail: work claw end of hammer under nail head. Pull evenly on handle.



V. Sledge Hammer (5-pound)

ILS PL-FI-II

1. A wooden handle with metal affixed to one end designed to strike heavy blows.
2. Used for
   a. breaking concrete.
   b. other heavy-duty uses.
3. Breaking concrete: after putting on safety glasses, hold handle firmly; with smooth even blows strike concrete.



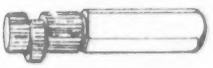
W. Level

ILS PL-FI-II

1. An instrument containing partially filled vials set at 90^{o} to each other.
2. Used to determine true horizontal.
3. Determine true horizontal: lay level on object to be leveled and read position of air bubble in vial.

X. Pipe Wrench

1. A metal wrench with an adjustable "L" shaped jaw at one end.
2. Used for gripping pipe and internally threaded fittings.
3. Gripping pipe and internally threaded fittings: adjust jaw to appropriate pipe size by turning knurled ring at jaw. Grip wrench with one or two hands (depending on size of pipe wrench) and pull clockwise to tighten internally threaded fittings onto threaded pipe. Pull wrench counter-clockwise to remove or loosen internally threaded fittings.



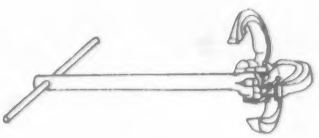
Y. Hack Saw

1. A thin metal blade with sharp toothed edge and handle at one end.
2. Used to cut metal.
3. Cut metal: secure metal and mark cut; grasp saw handle firmly and place blade on mark. Draw saw slowly to start cut. Push forward with even, smooth strokes.

ILS PL-RI-040

Z. Basin Wrench

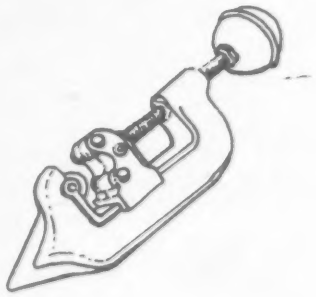
1. A long shank of metal with a sliding "T" handle at one end and an adjustable toothed jaw and dog at the other end.
2. Used to tighten or loosen nuts or bolts in areas difficult to reach.



3. Tighten or loosen nuts or bolts: grasp basin wrench in one hand near the "T" handle; adjust jaw for tightening or loosening nut. Place jaw around nut and turn handle clockwise to tighten nut or counter-clockwise to loosen nut.

AA. Copper Tubing Cutter

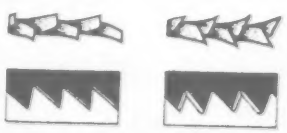
1. A clamp-like device with rollers and an adjustable cutting wheel.
2. Used to cut soft tubing.
3. Cut soft tubing: mark tubing where cut is desired. Open tubing cutter by turning wheel handle on end counter-clockwise to open. Place tubing cutter around tubing on mark; Turn wheel handle clockwise until cutting wheel touches tubing. Remove tubing cutter around tubing. Two turns, then turn wheel handle clockwise again. Repeat until tubing is cut through. Insert ream point of tubing cutter in end of tubing and twist left and right to remove burrs.



BB. Wood Saw

1. A thin metal blade with sharp, toothed edge and handle at one end.
2. Used to cut wood.
3. Cut wood: secure wood and mark cut. Grasp saw handle firmly and place blade on mark; draw saw slowly to start cut. Push forward with even smooth strokes.

ILS PL-FI-II



Rip Crosscut

CC. Adjustable-end Wrench

1. A metal wrench with an adjustable smooth jaw that forms a square opening with the body of the wrench.
2. Used to tighten or loosen bolts and nuts.
3. Tighten or loosen bolts or nuts: place wrench of appropriate size on head of bolt or nut. With one hand pull clockwise to tighten bolt or nut or pull counter-clockwise to loosen bolt or nut.

DD. Socket Wrenches

1. A metal cylindrical device with an opening at one end to fit specific sizes of nuts or bolts. A ratchet handle fits the other end.
2. Used to tighten or loosen nuts or bolts.
3. To tighten or loosen nuts or bolts: insert the ratchet handle in corresponding opening of socket. Set ratchet handle to loosen or tighten; pull handle in desired direction.

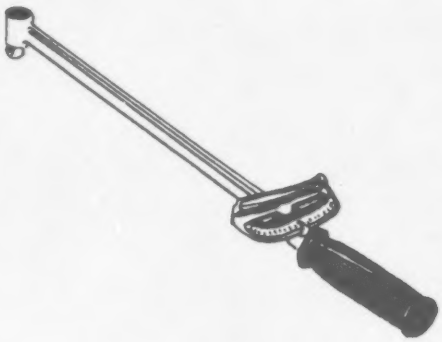
EE. Hex-head Wrench

1. A hexagonal shank of metal with one short end turned 90^{0} with its length.
2. Used to tighten or loosen hex head bolts.
3. Tighten or loosen hex head bolts: grasp hex key wrench of appropriate size in one hand; insert short end into hex head bolt. Pull clockwise to tighten bolt or pull counter-

clockwise to loosen.

FF. Torque Wrench

1. A T-handle ratchet wrench with a hexagonal socket at one end.
2. Used to tighten cast iron fitting (not hub couplings) bands.
3. Place socket over nut on hub coupling and turn clockwise to tighten.

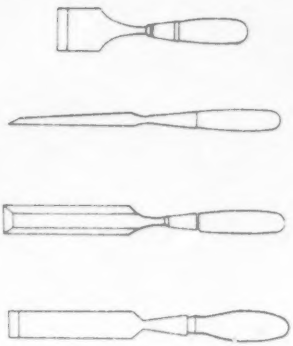


GG. Bull Point

1. A heavy shank of metal with a point at one end and square at the other for striking with a hammer.
2. Used for breaking concrete.
3. Breaking concrete: after putting on safety glasses, hold shank in one hand and place at desired location. Strike heavily with sledge hammer.

HH. Wood Chisel

1. A shank of metal with a sharp blade at one end and square at the other end for striking with a hammer.
2. Used for chiseling wood.
3. Chiseling wood: place flat of blade on area to be chiseled; strike square end with measured blows.



II. Long-nose Pliers

1. A scissors-like tool with flat long jaws for gripping.
2. Used for gripping small items or wire.

3. Gripping small items or wire: hold plier in one hand, place jaws around object and squeeze handles together.

JJ. Box-end Wrench

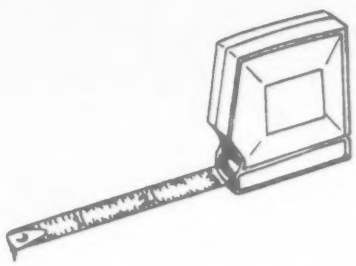
1. A metal wrench with an opening at each end corresponding to various sizes of nuts and bolts.
2. Used to tighten or loosen nuts and bolts.
3. Tighten or loosen nuts and bolts: place wrench of appropriate size on head of bolt or nut. With one hand pull clockwise to tighten nut or bolt or pull counter-clockwise to loosen bolt or nut.

KK. Diagonal Cutters

1. A scissors-like tool with short sharp jaws.
2. Used to cut wire or cotter pins.
3. Cut wire or cotter pins: hold cutter in one hand and place jaws around object to be cut; squeeze handles together.

LL. Tape Measure

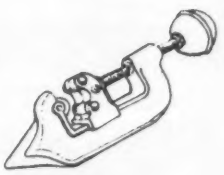
1. An expandable metal tape with inches and feet marked along its length starting with zero.
2. Used to measure linear distances.
3. Place end of tape on object to be measured and expand to desired length.



MM. Plastic Pipe Cutter

1. A clamp-like device with rollers and an adjustable cutting wheel and built-in reamer.
2. Used for cutting plastic pipe.
3. Mark where cut is desired. Open pipe cutter by turning wheel handle on end counter-clockwise; place pipe cutter around pipe centered on mark. Turn wheel handle clockwise until cutting wheel touches pipe. Grasp handle and revolve pipe cutter around pipe two turns. Turn wheel handle clockwise again. Repeat until pipe is cut through. Insert reamer and twist left and right.

ILS PL-RI-04C

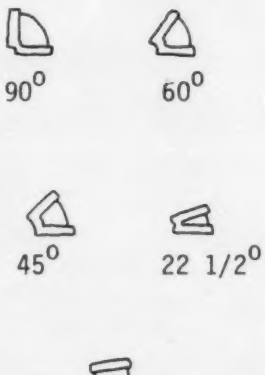


9.0 Materials/Plumbing

INSTRUCTIONAL OUTCOMES: The student will be able to identify and explain the use of common plumbing materials.

INTRODUCTION: The skilled worker is able to select the correct material for the job.

PRESENTATION

TEACHING OUTLINE	TEACHING METHODS AND AIDS
9.1 Galvanized Steel A. Water distribution fittings inside or outside a building 1. Popular sizes 1/2" to 2". B. Basic fittings 1. 90° elbow. 2. 45° elbow. 3. Tee, reducing tee. 4. Coupling. 5. Reducer. 6. Bushings, union.	Demonstrate and Explain ILS CO-CP-55 ILS CO-CP-52  90° 60° 45° 22 1/2° 11 1/4° Elbows

C. Galvanized pipe available in 21' lengths; popular sizes 1/2" through 2"

D. Fittings and pipe are joined by "threading"

Sanitary Tee

Y-Branch

9.2 Copper

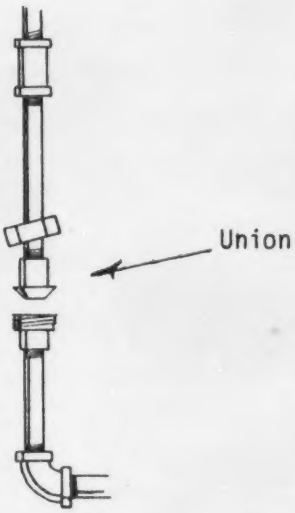
ILS CO-CP-58
ILS CO-CP-52

A. Water distribution fittings inside or outside a building
   1. Popular sizes 1/2" through 2".

B. Basic fittings
   1. 90^{o} elbow.
   2. 45^{o} elbow.
   3. Tee, reducing tee.
   4. Coupling.
   5. Reducer.
   6. Union.

Increaser

Reducer



C. Hard copper pipe is available in 20' lengths; soft copper pipe is available in 60' coils; popular sizes 1/2" through 2"

D. Fittings and pipe are joined by soldering

9.3 ABS

ILS PL-FI-II

A. Plastic drainage and vent fittings (acrylonitrile-butadiene-styrene) inside buildings and outside sewers.

Sanitary Cross

Double Y

B. Basic fittings

1. 90° drainage elbow.
2. 90° vent elbow.
3. Wye
4. Cleanout tee.
5. Sanitary tee, reducing tee.
6. Combination wye and 1/8 bend.
7. Closet flange.
8. P-trap.
9. Coupling.
10. Reducers.

C. ABS plastic pipe is available in 20' lengths, popular sizes 1 1/2 through 4", black in color.

D. Fittings and pipe are joined by solvent cementing.

Sanitary Tee

Tee

Sanitary Cross

Cleanout Tee

Sanitary Tee

Reducing Wye

9.4 PVC

A. Plastic water distribution fittings outside buildings (polyvinyl-chloride)

ILS PL-RI-04C

B. Basic fittings

1. 90° elbow.
2. Tee, reducing tee.
3. 45° elbow.
4. Adapters male and female.
5. Couplings.
6. Reducers.

Double Hub 1/8 Bend

Double Hub 1/4 Bend

C. PVC plastic pipe is available in 20' lengths; popular sizes 1/2" through 2"; white in color.

Double 1/4 Bend

D. Fittings and pipe are joined by "solvent cementing"

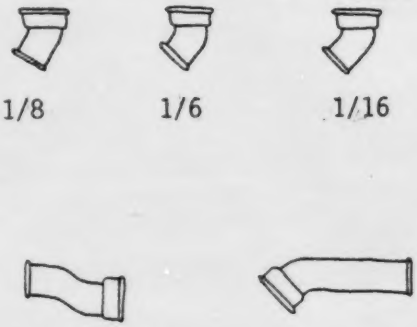
9.5 Cast Iron

ILS PL-RI-OIC

A. Drainage fittings inside and outside buildings

B. Basic fittings

1. 90° drainage elbow.
2. 45° drainage elbow.
3. Wye.
4. Cleanout tee.
5. Sanitary tee.
6. Reducing tee.
7. Combination wye and 1/8 bend.
8. Closet flange.
9. P-trap.
10. Reducers.



Bends

C. Cast iron NO HUB pipe is available in 10' lengths; popular sizes 1 1/2" through 4"

D. Fittings and pipe are joined by "NO HUB" couplings

D. Fittings and pipe are joined by "solvent cementing"

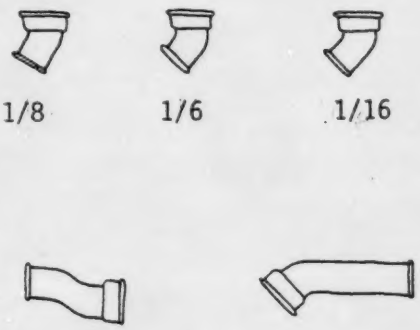
9.5 Cast Iron

ILS PL-RI-OIC

A. Drainage fittings inside and outside buildings

B. Basic fittings

1. 90° drainage elbow.
2. 45° drainage elbow.
3. Wye.
4. Cleanout tee.
5. Sanitary tee.
6. Reducing tee.
7. Combination wye and 1/8 bend.
8. Closet flange.
9. P-trap.
10. Reducers.



Bends

C. Cast iron NO HUB pipe is available in 10' lengths; popular sizes 1 1/2" through 4"

D. Fittings and pipe are joined by "NO HUB" couplings

10.0 Plumbing Processes

INSTRUCTIONAL OUTCOMES: The student will be able to describe and explain the reason for various plumbing processes, as well as to demonstrate basic skill profiency in their execution.

INTRODUCTION: The skilled worker is able to perform common tasks efficiently and expertly.

PRESENTATION

TEACHING OUTLINE	TEACHING METHODS AND AIDS
10.1 Basic Processes	Demonstrate and Explain
A. Cutting Steel Pipe	ILS CO-CP-55
1. Select pipe.	Refer to Instructor Guide
2. Secure pipe in vise.	8.0 Tools, for Technique
3. Mark pipe.	
4. Cut pipe.	
B. Threading Steel Pipe	ILS CO-CP-55
1. Secure pipe in vise.	
2. Select die.	
3. Apply die.	
4. Apply oil during cutting.	
5. Cut threads.	

C. Reaming Steel Pipe
   1. Secure pipe in vise.
   2. Insert reamer in pipe.
   3. Ream pipe.

D. Joining Steel Pipe and Fittings
   1. Secure pipe.
   2. Apply joint compound.
   3. Place fitting on threaded pipe end.
   4. Tighten fitting.

E. Cutting Copper Pipe.
   1. Select pipe.
   2. Secure pipe.
   3. Cut pipe with tubing cutter.

F. Reaming Copper Pipe
   1. Secure pipe in hand or vise.
   2. Insert reamer into pipe.
   3. Rotate reamer left and right.

G. Joining Copper Pipe and Fittings
   1. Clean pipe.
   2. Clean fitting.
   3. Apply flux to fitting.
   4. Apply flux to pipe end.
   5. Insert pipe into fitting.
   6. Heat fitting with torch.
   7. Apply solder to joint.

H. Cutting Plastic Pipe (ABS-PVC)
   (hand saw miter box method)
   1. Select pipe.
   2. Mark pipe.
   3. Secure pipe in miter box.
   4. Cut with saw.

I. Cutting Plastic Pipe (ABS-PVC)
(wheel cutter method)

1. Select pipe.
2. Mark pipe.
3. Place cutter on mark.
4. Cut pipe.

J. Ream Plastic Pipe (ABS-PVC)

1. Insert knife or reamer and twist.

K. Joining PVC Plastic Pipe and Fittings

1. Clean inside fittings with primer cleaner.
2. Clean end of pipe with primer cleamer.
3. Apply solvent cement inside fitting.
4. Apply solvent cement on end of pipe.
5. Insert pipe into fitting and turn 1/4 circle.
6. Hold together for a few seconds.

L. Joining ABS Pipe and Fittings
(Acrylonitrile-Butadiene-Styrene)

1. Clean fitting with cloth.
2. Clean pipe end with cloth.
3. Apply solvent to fitting.
4. Apply solvent to pipe end.
5. Insert pipe end into fitting.
6. Turn pipe in fitting 1/4 turn.
7. Hold for several seconds.

M. Cutting Cast Iron Pipe
(Snap Cutter Method)

1. Lay pipe on ground with one end on 2 X 4.
2. Place snap cutter chain on pipe and cut.

ILS PL-RI-01C

N. Joining Cast Iron Pipe and Fittings
(No-Hub Band Method)

1. Select pipe.
2. Select Fitting.
3. Apply NO-HUB band to pipe.
4. Insert fitting into NO-HUB band.
5. Align fitting and pipe.
6. Secure NO-HUB band with torque wrench.

SUGGESTED READING

1. Fala, Mario J.
Uniform Plumbing Code Study Guide

International Association of Plumbing and Mechanical Officials, 1977

2. New Jersey Department of Education
I Know--A Vocabulary Game for the Plumbing Trade

State of New Jersey Department of Education
Division of Vocational Education

11.0 Basic Plumbing Repair Concepts

INSTRUCTIONAL OUTCOMES: Student will demonstrate and execute basic trade skills by completing a project to the satisfaction of the instructor.

INTRODUCTION: This instructional unit provides students an opportunity to practice techniques followed in the Pacific Northwest; appropriate techniques will have been learned in previous topics in this guide.

PRESENTATION

TEACHING OUTLINE	TEACHING METHODS AND AIDS
11.1 Leaky Faucet Repair A. Removal of Faulty Washer 1. Shut off water supply to dripping faucet. 2. Remove faucet handle retaining screw. 3. Remove handle. 4. Remove valve retaining nut with wrench or slip joint pliers. a. use protective cloth between nut and pliers. 5. Unscrew valve stem from faucet.	Explain and Discuss Administer Project Sheet

6. Check for wear.
   a. stem threads.
   b. washer.
   c. seat.
7. Remove old washer and retaining screw (if any).

B. Reseat Valve Face with Sealing Tool
1. Clockwise turns with firm pressure.

C. Re-assembly of Faucet
1. Replace new washer and retaining screw (if necessary).
2. Replace valve stem into valve.
3. Prepare threads of faucet with teflon tape or pipe joint compound.
4. Replace retaining nut with wrench or slip joint pliers.
   a. use protective material between nut and tool.
5. Replace handle and retaining screw and cap (if necessary).
6. Restore water supply to faucet.
7. Check system for leaks.
   a. turn on faucet.
8. Clean up work area.

PLUMBING PROJECT SHEET

1. Indoor fixture.

The student will complete this project, involving replacing a washer, grind a valve seat and re-assemble a fixture, using appropriate tools safely, to industry standards.

REQUIREMENTS

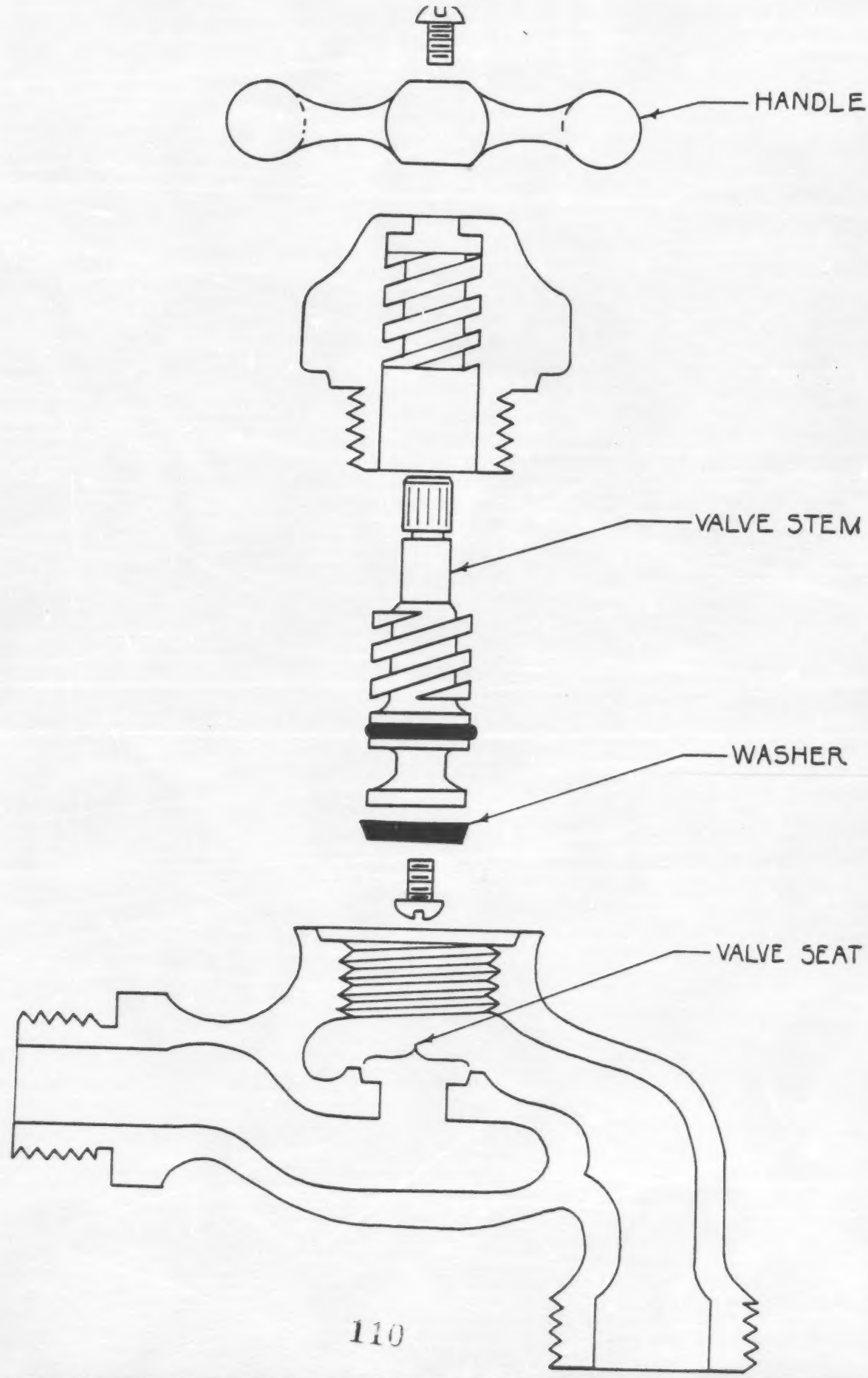
A dripping faucet and sut-off valve for branch of leaking faucet (or shut-off main).

TOOLS

slip-joint pliers or pipe wrench
assorted screwdrivers
re-seating tool

MATERIALS

faucet valve washer assortment
rag(s) or cloth(s)
teflon tape or pipe joint compound


HANDLE
VALVE STEM
WASHER
VALVE SEAT

STEPS TO COMPLETION:

1. Shut off water supply to dripping faucet; if shut off at main, be sure to allow for turning off hot water heater if required.
2. Remove cover cap from top of faucet handle (if necessary).
3. Remove retaining screw.
4. Remove handle; use care, not force.
5. Remove valve retaining nut using appropriate wrench or slip-joint plier. Protect metal surface with rag or other soft material.
6. Unscrew valve stem from faucet.
7. Check valve stem threads for wear.
8. Check washer for wear.
9. Select replacement washer.
10. Remove old washer and replace with new one.
11. Re-seat valve seat with seating tool; several turns (usually clockwise only) with firm pressure.
12. Replace valve stem into valve.
13. Using teflon tape or joint compound, prepare threads on valve.
14. Replace retaining nut using protective material and wrench or slip-joint plier.
15. Replace handle, adjusting to proper location in the full "off" position.
16. Restore water at shut-off valve.
17. Check for leaks at faucet valve retaining nut and shut-off valve (disturbing shut-off valve may cause a leak of its own).
18. Replace handle retaining screw.
19. Replace cover cap (if necessary).
20. Clean up.

APPENDIX

OCCUPATIONAL ANALYSIS

TASK INVENTORY

PLUMBER

Job Title

Analyst

INSTRUCTIONS:

List each manipulative and knowledge skill relating to the job listed above. To the right of the page are three sections of columns asking specific questions about the Entry Level, Frequency of Performance and Instruction Attained At. An "X" should be placed, by the analyst, opposite each task in the appropriate box of the "ENTRY LEVEL" and "FREQUENCY OF PERFORMANCE" sections. Section three, "INSTRUCTION ATTAINED AT" is to be completed by state representative persons selected by the state department specialist.

Duty No.	Task No.	Task Description	Entry Level		Frequency of Performance			Instruction Attained at			
			Entry	On The Job	Small Amount	Average Amount	Great Amount	High School	Community College	On-the-Job Training	Related Training
1	0	ROUGH-IN DRAINAGE INSTALLATIONS									
	1	Layout and assemble building sewer					X		X	X	X
	2	Layout and assemble building drain					X		X	X	X
	3	Layout and assemble soil and waste stacks					X		X	X	X
	4	Layout and assemble soil and waste drains					X		X	X	X
	5	Layout and assemble drain vents					X		X	X	X
	6	Layout and assemble traps					X		X	X	X
	7	Layout and assemble cleanouts					X		X	X	X
	8	Calculate the fixture unit capacity of a:					X		X	X	X
		a. soil stack					X		X	X	X
		b. soil drain					X		X	X	X
		c. waste stack					X		X	X	X
		d. waste drain					X		X	X	X
		e. stack vent					X		X	X	X
		f. vent stack					X		X	X	X
		g. other vents					X		X	X	X
	9	Calculate the fixture unit value of the following installations:					X		X	X	X
		a. bathtubs					X		X	X	X
		b. bidets					X		X	X	X
		c. dental units or cuspidors					X		X	X	X
		d. drinking fountains					X		X	X	X
		e. floor drains					X		X	X	X
		f. laundry tubs					X		X	X	X
		g. clothes washer					X		X	X	X
		h. showers					X		X	X	X
		i. sinks					X		X	X	X
		j. urinals					X		X	X	X
		k. wash basins					X		X	X	X
		l. water closets					X		X	X	X
	10	Select the correct types of material according to the use intended					X		X	X	X
	11	Select and use the correct type of fitting according to the use intended					X		X	X	X
	12	Locate and remove drain stoppage					X			X	X

TASK INVENTORY

PLUMBER

Job Title

Analyst

INSTRUCTIONS

List each manipulative and knowledge skill relating to the job listed above. To the right of the page are three sections of columns asking specific questions about the Entry Level, Frequency of Performance and Instruction Attained At. An "X" should be placed, by the analyst, opposite each task in the appropriate box of the "ENTRY LEVEL" and "FREQUENCY OF PERFORMANCE" sections. Section three, "INSTRUCTION ATTAINED AT" is to be completed by state representative persons selected by the state department specialist.

Duty No.	Task No.	Task Description	Entry Level		Frequency of Performance			Instruction Attained at			
			Entry	On The Job	Small Amount	Average Amount	Great Amount	High School	Community College	On-the-Job Training	Related Training
1	13	Use appropriate instruments for accurate measurements									
		a. non-precision instruments					X		X	X	X
		b. precision instruments					X		X	X	X
2	0	INSTALL COLD WATER SYSTEM									
	1	Calculate water pressure for the meter					X		X	X	X
	2	Calculate pressure for the water service					X		X	X	X
	3	Install water meter and strainers					X		X	X	X
	4	Install water service					X		X	X	X
	5	Measure pipe used in supply piping systems					X		X	X	X
	6	Layout pipe and fittings used in supply piping systems					X		X	X	X
	7	Prepare pipe and fittings used in supply piping system					X		X	X	X
	8	Assemble pipe and fittings used in supply piping system					X		X	X	X
	9	Install various types of pipe and fittings, using the following materials									
		a. brass			X				X	X	X
		b. copper					X		X	X	X
		c. cast iron				X			X	X	X
		d. galvanized malleable iron				X			X	X	X
		e. galvanized wrought iron				X			X	X	X
		f. galvanized steel				X			X	X	X
		g. lead			X				X	X	X
		h. PE			X				X	X	X
		i. P.V.C.				X			X	X	X
3	0	INSTALL HOT WATER SYSTEM									
	1	Layout hot water heater					X		X	X	X
	2	Install hot water heater					X		X	X	X
	3	Install hot water valves and fittings					X		X	X	X
	4	Calculate pressure for hot water supply					X		X	X	X
	5	Measure pipe used in hot water system					X		X	X	X
	6	Layout pipe and fittings used in hot water supply piping system					X		X	X	X
	7	Prepare pipe and fittings used in hot water supply piping system					X		X	X	X

TASK INVENTORY

PLUMBER
Job Title

Analyst

INSTRUCTIONS

List each manipulative and knowledge skill relating to the job listed above. To the right of the page are three sections of columns asking specific questions about the Entry Level, Frequency of Performance and Instruction Attained At. An "X" should be placed, by the analyst, opposite each task in the appropriate box of the "ENTRY LEVEL" and "FREQUENCY OF PERFORMANCE" sections. Section three, "INSTRUCTION ATTAINED AT" is to be completed by state representative persons selected by the state department specialist.

Duty No.	Task No.	Task Description	Entry Level		Frequency of Performance			Instruction Attained at			
			Entry	On The Job	Small Amount	Average Amount	Great Amount	High School	Community College	On-the-Job Training	Related Training
3	8	Assemble pipe and fittings used in hot water supply piping system					X		X	X	X
	9	Install various types of pipe & fittings used in a hot water supply piping system, using the following materials:									
		a. brass			X				X	X	X
		b. copper					X		X	X	X
		c. cast iron			X				X	X	X
		d. galvanized malleable iron				X			X	X	X
		e. galvanized wrought iron				X			X	X	X
		f. galvanized steel				X			X	X	X
		g. lead			X				X	X	X
4	0	INSTALL GAS SYSTEM									
	1	Layout and size gas piping					X		X	X	X
	2	Assemble pipe and fitting					X		X	X	X
	3	Install gas pipe system					X		X	X	X
	4	Install gas appliances					X		X	X	X
		a. gas hot water heater					X		X	X	X
		b. gas stove					X		X	X	X
		c. gas furnace					X		X	X	X
		d. others					X		X	X	X
	5	Prepare job to meet test and inspection requirements					X		X	X	X
	6	Service gas piping and appliances				X			X	X	X
5	0	INSTALL FIXTURES									
	1	Select plumbing fixtures to comply with established specifications and local code					X				
	2	Install fixtures:					X		X	X	X
		a. bathtubs					X		X	X	X
		b. bidets					X		X	X	X
		c. dental units or cuspidors					X		X	X	X
		d. drinking fountains					X		X	X	X
		e. floor drains					X		X	X	X
		f. laundry tubs					X		X	X	X
		g. clothes washers					X		X	X	X
		h. showers					X		X	X	X
		i. sinks					X		X	X	X
		j. urinals					X		X	X	X

TASK INVENTORY

PLUMBER
Job Title

Analyst

INSTRUCTIONS:
List each manipulative and knowledge skill relating to the job listed above. To the right of the page are three sections of columns asking specific questions about the Entry Level, Frequency of Performance and Instruction Attained At. An "X" should be placed, by the analyst, opposite each task in the appropriate box of the "ENTRY LEVEL" and "FREQUENCY OF PERFORMANCE" sections. Section three, "INSTRUCTION ATTAINED AT" is to be completed by state representative persons selected by the state department specialist.

Duty No.	Task No.	Task Description	Entry Level: Entry	Entry Level: On The Job	Frequency of Performance: Small Amount	Frequency of Performance: Average Amount	Frequency of Performance: Great Amount	Instruction Attained at: High School	Instruction Attained at: Community College	Instruction Attained at: On-the-Job Training	Instruction Attained at: Related Training
5	2	k. wash basins					X		X	X	X
		l. water closets					X		X	X	X
	3	Repair and service various plumbing fixtures and trim					X		X	X	X
	4	Use necessary precautions to protect Public Health					X		X	X	X
6	0	BLUEPRINT READING AND SKETCHING									
	1	Construct basic blueprint drawings as they apply to plumbing				X			X		X
	2	Select and draw symbols which will be used on said blueprint drawing				X			X		X
	3	Use instruments to draw and sketch basic plumbing layouts				X			X		X
		a. architects scale				X		X	X		X
		b. engineers scale				X		X	X		X
		c. metric scale				X		X	X		X
		d. graphic scale				X		X	X		X
		e. protractor				X		X	X		X
		f. triangle and compass				X		X	X		X
	4	nterpret blueprints and schematic drawings for:					X	X			
		a. take-off					X		X	X	X
		b. construction purposes					X		X	X	X
		c. bidding					X		X	X	X
7	0	RIGGING									
	1	Construct scaffolding				X			X	X	X
	2	Use correct hoisting signals									
	3	Tie and rig knots and hitches				X		X	X	X	X
	4	Use correct procedures in attaching lifting equipment				X			X	X	X
8	0	WELDING									
	1	Use various types of welding equipment:			X			X	X	X	X
		a. cylinder			X			X	X	X	X
		b. bulk			X			X	X	X	X
		c. guages			X			X	X	X	X
		d. tips			X			X	X	X	X
		e. torches			X			X	X	X	X

TASK INVENTORY

PLUMBER

Job Title

Analyst

INSTRUCTIONS

List each manipulative and knowledge skill relating to the job listed above. To the right of the page are three sections of columns asking specific questions about the Entry Level, Frequency of Performance and Instruction Attained At. An "X" should be placed, by the analyst, opposite each task in the appropriate box of the "ENTRY LEVEL" and "FREQUENCY OF PERFORMANCE" sections. Section three, "INSTRUCTION ATTAINED AT" is to be completed by state representative persons selected by the state department specialist.

Duty No.	Task No.	Task Description	Entry Level		Frequency of Performance			Instruction Attained at			
			Entry	On The Job	Small Amount	Average Amount	Great Amount	High School	Community College	On-the-Job Training	Related Training
8	1	f. hoses			X			X	X	X	X
		g. personal protective equipment			X			X	X	X	X
		h. tools			X			X	X	X	X
		i. safety equipment			X			X	X	X	X
9	0	MAINTAIN SAFE WORKING CONDITIONS									
	1	Wear appropriate clothing					X	X	X	X	X
	2	Wear protective devices that provide security from injury				X		X	X	X	X
		a. hard hat				X		X	X	X	X
		b. safety glasses				X		X	X	X	X
		c. gloves				X		X	X	X	X
		d. dust mask				X		X	X	X	X
		e. shield				X		X	X	X	X
	3	Use safe procedures in lifting				X		X	X	X	X
	4	Locate and identify equipment guards and markings that alert persons to hazards				X		X	X	X	X
	5	Apply OSHA standards for the plumbing and construction trades				X			X	X	X
10	0	FIRST AID									
	1	Administer basic first aid techniques			X			X	X	X	X
11	0	CODE									
	1	Apply code requirements for all installations					X		X	X	X